The Chemical Age

VOL LXII 4 FEBRUARY 1950 No 1595

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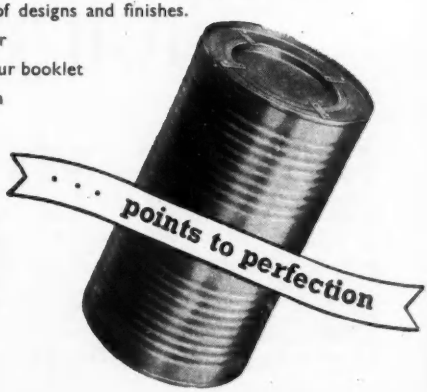

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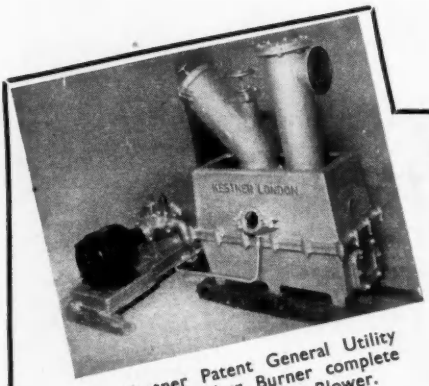

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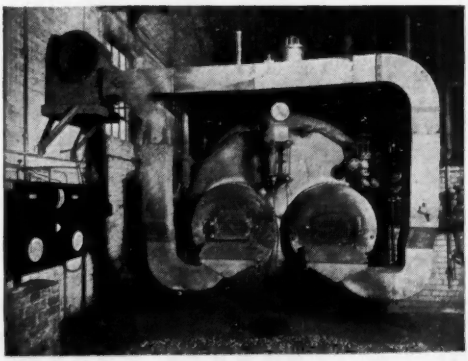

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Facts about Chemical Industry

IT was in September, 1948, that the President of the Board of Trade called upon the chemical industry to give an account of itself. Not long before Mr. Harold Wilson had announced that the industry was to be spared "the ordeal by Working Party." The awareness which he showed then of the extreme complexity of chemical industry has now been justified, and presumably made very much more acute, by the publication this week by the Association of British Chemical Manufacturers of the survey of chemicals and chemical undertakings, which has required over a year's work and the help freely given by five other trade associations and industrial firms. No one giving even cursory attention to the Report on Chemical Industry, 1949, will ask why it should have required more than a year to collate. It is a monumental work, regardless of its having been compressed into 75 pp.; and because it is the only authoritative attempt to define what chemical industry is, and what are its intentions and prospects related to past performance, it must form the standard reference in this context for many years to come. The ABCM and its collaborators are deserving of some congratulation on having made manifest that what most of us term "the chemical industry," which some have regarded as a suitable subject for State enterprise, so far from being an entity is one of the most complicated agglomerations of highly specialised activities in the United Kingdom, and intertwined with them are the interests of nearly every other form of national production.

The ability of the ABCM to produce this account at relatively short notice is partly explained by the wise decision that chemical industry must in this case be defined as those undertakings responsible for the production—as opposed to processing or conversion to other uses—of 17 groups of essential chemicals. The chosen classification was this: Sulphuric acid, alkalis (including chlorine); other inorganic acids and salts (including carbide); industrial gases; nitrogen fertilisers; soluble phosphate fertilisers; other chemical fertilisers; heavy organic chemicals; chemicals for pharmaceutical and veterinary products; miscellaneous fine chemicals; dyestuffs and intermediates; pigments; explosives (industrial only); chemicals for pest control and for agricultural and horticultural purposes not elsewhere included; plastic materials and synthetic resins; miscellaneous chemi-

On Other Pages

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cals not covered by the above groups; coal tar distillation products.

To reduce the candidates for inclusion among chemical producers even to a list of these proportions must have called for severe restraint on the part of the compilers, but even in this simplified category the ABCM found it impossible to identify undertakings with the complete production of one particular chemical material or to distinguish all the main producers. The report does not disguise the fact, which would appear to have been inevitable, that the evidence of a number of firms having a diversity of interests had to be omitted from the sectional summaries. There can be no doubt, however, that if the Report on the Chemical Industry has to be regarded as a fair sample rather than the alpha and omega of the subject, it still gives an extremely intimate yet unbiased picture of the sources of the main chemical supports of industries in general, how they came into being, their enterprise and productivity in the past and their proposals and requirements for further development. Any impartial judgment founded on the facts thus presented must acknowledge several things of peculiar interest at the moment.

There can in the first place be no doubt that the main body of chemical production in this country is at least as well able as any counterpart in industries as a whole to provide for all essential needs and leave an export margin, so long as a few vital raw materials are not diverted from it. Secondly, no development council or other Government - sponsored agency could have brought about a greater rate of expansion, both of production and of objectives, than has now been shown to have taken place in 25 years or less in capacity to produce such things as explosives, dyestuffs, plastics and chemical fibres, medicinal chemicals, agricultural and veterinary materials and high pressure products (i.e., the synthetic form of ammonia and methyl alcohol and coal-derived petrol). This, however, is only one of a host of proofs given here that the making of chemicals in the United Kingdom has attained a degree of ingenuity and competence which no outside intervention could enhance. The section considered here has the use of all the capital it needs—£231 million in plant and money, equivalent to some £400 million at present values—and it employs its great resources with a courage and liberality towards advancement by research and innovation which almost certainly have no parallel. If a large part is in the hands of "a monopoly" there is no alternative that would yield essentials so efficiently and cheaply.

Notes and Comments

Science and the Festival

"DISCOVERY" will be the theme of many or most of the displays which will form the basis of the 1951 Exhibition, so that the sciences, and especially chemistry, will be the inspiration of most of them. That appeared to be the significant fact contained in the considerably amplified data proffered by the exhibition authorities last week, in which the emphasis on science or technology, not only in the Dome of Discovery and the South Bank Exhibition, but in the Science Museum, Kensington, the Kelvin Hall, Glasgow, and the road and sea-borne exhibitions, evidenced the intimate co-operation which will be required from large numbers of specialists. The other salient fact was the success the project has already had in securing the participation, as members of the Council of Science and Technology or of specialists' panels, of the principal figures in each of the fields concerned. Because this is to be essentially a popular presentation, not a science congress, the need for highly expert direction is indispensable. Thousands will draw lifelong impressions of the aims and methods of science from these aspects of the Festival of Britain, and it is well that the interpretation will come from the only authoritative sources. It would be hard to find a better occasion to explain the British rôle in the peaceful uses of atomic power and nuclear physics. The omission of any reference to the AERE programme for the exhibition is hard to explain.

Tracers for Industry

THERE are numerous manufacturing processes and methods of their control, both in the chemical and some other industries, to which radioactive tracer element technique is already being applied, and its further uses in production and research are thought by people well qualified to judge to be almost limitless. An arresting bid to gauge the extent of industrial interest in this very promising technique, if expert guidance were available in the factories, is being adopted by one British firm (Mactaggart & Evans, Ltd.). This is in the form of a questionnaire which is being sent to some 10,000 manufacturing firms of all kinds in Britain, Norway, Denmark, Sweden, and Holland, asking if they think radioactive tracer technique could help their individual research or production and whether they contemplate establishing their own laboratories. The inquiry is also intended to gauge the present requirement of special compounds containing tracer elements. The replies must, of course, be treated as confidential, but it is proposed to publish the overall results of the survey, which may have the effect of persuading the authorities to make available sooner a sufficiently wide range of radioactive materials. The desirability of that seems to have been better recognised in the U.S.A. as a means of reducing still further the time occupied in many productive and scientific processes. The same firm is now issuing a bulletin which deals comprehensively in generally intelligible terms with the use of radioactive tracer elements in industry and research.

Objections to Agene

IN arresting contrast with the "good Press" which seems to be accorded to the general subject of chemicals is the uncompromising attitude taken by the Medical Research Council, represented in particular by the broadcast and other activities of its secretary, Sir Ernest Mellanby, designed to discourage the somewhat indiscriminate use of chemical materials in foodstuffs. One direct result has been the recommendation by the Ministries of Food and Health that the use of nitrogen trichloride (Agene; NCl_3) as a bleach and improver of bread should stop. But, indicating how intimate has become the dependence upon chemical improvers, the Ministries are in favour of

the use in flour of harmless chlorine dioxide, when home producers of a suitable form of this additive are equipped for the job. That will not be for some time. The Government departments seem to have been egged into rather reluctant action, for they are at some pains to minimise the possibility of harmful effects of the chemical methods of procuring a white loaf. After long study of the subject with the milling industry and the MRC, they say they can find no evidence that agenised flour is at all toxic to man, but in view of the deleterious effect on certain animals (dogs and ferrets in particular, according to the medical council) they considered the use of the chemical should be stopped. The fact that the Agene method has been in use in Britain, Canada and the U.S.A. for 75 years is noted, but not the decision in the U.S.A. last August to exclude nitrogen trichloride from bread (THE CHEMICAL AGE, *60*, 37). That, admittedly, does not prove the case for the prosecution.

Microchemistry Congress

A LIVELIER interest than is commonly displayed in relatively distant congresses is felt in chemistry circles here in the announcement that the Austrian Microchemical Society, under the presidency of Professor H. Lieb, is to hold the first International Microchemical Congress in Graz from July 2 to 6. There is sound warrant for this. In Graz the work of Emich and Pregl first laid the foundations of microchemistry, and from Graz the techniques spread till they have now become worldwide. In addition, the event appropriately commemorates the tenth anniversary of the death of Emich and the twentieth anniversary of the death of Pregl. Many well-known microchemists have already promised to attend and to present papers. The third pioneer in microchemistry, Professor F. Feigl, will come from Brazil. Other names of note are Belcher of Great Britain, Benedetti-Pichler of the U.S.A., Kahane of France, Wenger of Switzerland, Wilson of Northern Ireland, and Zimmermann of Germany. Other matters of interest in the provisional programme include the bestowal of honorary membership of the Austrian Microchemical Society, reports, exhibitions, receptions by the Styrian Government and by the Municipal Council of Graz. The secretarial duties are being carried out by Dr. H. Melissa, 1 Internationales Congress, Graz, Schlögelgasse 9, Austria.

Safety in Solvents Works

THE need for a high degree of safety-mindedness in plants producing solvents and similar highly volatile materials is sufficiently self-evident to make the task of the safety officer a little lighter than it might be elsewhere. The willingness to obey all the safety rules is, however, anything but automatic, so that the experiences of one large producer—albeit an American one—in minimising the accident rate are worth recording. The marked improvement in this respect achieved last year in U.S. solvents and distilled spirits plants can be attributed—according to Colonel Thomas F. Brown, of the National Distillers' Products Corporation—to the recognition by all ranks of the prime importance of observing the rules and the fact that a lead was given by the directors and chief managerial staff. To ensure that its plant safety arrangements were better than those statutorily required, National Distillers had encouraged friendly inter-plant, and inter-departmental rivalry in the matter of accident prevention work. This safety-consciousness was engendered by methods not new to the managements and workpeople of most chemical plants in the U.S.A. or in this country. Rather was it produced by a concentrated tightening-up of known preventive measures, and this, writes Colonel Brown in the *New York Journal of Commerce*, produced unexpected benefits for all concerned. In 1948 the disabling injuries per million man-hours worked totalled 11.49 for all American industry, whereas the distilling industry rate was 9.2. 1949 plant safety figures—not yet completed—were likely to provide just as favourable a picture.

ATOMIC ENERGY TALKS

More Data to be Disclosed?

REPRESENTATIVES of Canada, the United Kingdom, and the United States will meet at Britain's Atomic Energy Research Establishment, Harwell, Berks., on Thursday next (February 9-12) to discuss the further release of information on atomic energy work by the three countries. The meeting is the fourth in a series concerned with policy in the declassification of atomic energy documents. It will continue the work from the point at which it was left by the third conference, at Chalk River, Ontario, last September.

The new discussions will take acount of the announcement made on September 23 that an atomic explosion had occurred in the U.S.S.R. Recommendations resulting from the discussions will be reported to the Atomic Energy Agencies of the three Governments, for review before any final revisions in the existing uniform declassification guide are made.

The British delegates will be: Sir John D. Cockcroft (director, Atomic Energy Research Establishment); Prof. H. J. Emeléus (Cambridge University); Prof. D. Hanson (Birmingham University); Prof. R. E. Peierls (Birmingham University); and Mr. M. W. Perrin (deputy controller of atomic energy, Ministry of Supply).

Mr. J. H. Awbery and Mr. J. F. Jackson, of the Ministry's atomic energy division, will act as joint secretaries.

High Capacity Diffusion Pump

A NEW fractionating oil diffusion pump, said to be superior to previous pumps of the same size, has been developed by Distillation Products Industries, New York. This, the MCF-300, affords the extremely high speed of approximately 300 litres per second in the range 10^{-5} to 10^{-8} mm. Hg, the highest ever achieved with a 4-in. ID pump casing. An ultimate vacuum of 5×10^{-7} mm. Hg. at 25°C. is attainable. The new pump embodies a 3-stage concentric cylinder type of fractionating jet assembly fitted into an enlarged boiler, the latter providing vaporising surface sufficient to ensure adequate fractionation and jet power and enabling external electrical heating units to be used. The powerful jets are said to pump hydrogen one and one-half times faster than air and will operate against a forepressure of more than 0.150 mm. Hg.

BRITISH EXPERTS FOR U.S.A.

ECA Sponsors Two Research Projects

BETTER and more economic supplies of fuel both for industrial and domestic use it is hoped may result from the visits of two British scientists to the U.S.A., organised under the Economic Co-operation Administration's technical assistance programme.

Dr. E. T. Wilkins, principal scientific officer of the Fuel Research Station, has left to spend a year at Gorgas, Alabama, where the U.S. Bureau of Mines and the Alabama Power Company are carrying out large-scale experiments on the underground gasification of coal.

While some experiments of the same kind are being carried out in this country, it was felt that not only would Dr. Wilkins' participation in the American tests avoid duplication of scientific investigation, as recommended by the OEEC, but it was hoped that the doctor's knowledge and experience would also be of benefit to the U.S. scientists.

The other British expert is Mr. T. F. Hurley, also of the Fuel Research Station, who is due to reach the U.S.A. in April for a six-week study of gas turbine development.

As revealed by Dr. H. Roxbee Cox, chief scientist to the Ministry of Fuel and Power, at a Press conference last week, work of considerable promise was being done on various types of turbine, but it was felt that first-hand knowledge of American investigations would help in carrying out further research projects.

French Fertiliser Experiments

TESTS in the North of France using as an agricultural fertiliser direct anhydrous ammonia are reported to have given completely satisfactory results. Three tests were made on beetroot cultivation and, taking into consideration local conditions, output of areas treated with anhydrous ammonia was comparable to that of areas treated with sulphate of ammonia or nitrates. Conclusions show that anhydrous ammonia has a more rapid action and is more regular in its effect, while the relatively low cost is important. Its use is particularly interesting in connection with beet cultivation which needs a good deal of nitrogen, and less in the case of wheat, which is generally sown over the beetroot and benefits from the residue in the soil. Direct applications are also being tried on rape-seed but it is still too early to give results. Other tests concern rice cultivation.

PRODUCTION RECORDS

I.C.I. Petrol and Urea

RECORD outputs of products by I.C.I., Ltd., at Billingham, which will directly stimulate agriculture, rubber, oil, petrol, building, plastics, pharmaceuticals, textiles, and many other essential industries, are announced in a "production" issue of the group's Billingham news sheet, summarising 1949.

One record was achieved at the oil works where 47,000 tons of aviation spirit were produced for the Air Ministry following an appeal by the Ministry for as much octane fuel as possible for the use of aircraft engaged on the Berlin airlift. At the time, I.C.I. promised 40,000 tons, and hoped to reach 45,000. The highest production of pool petrol since 1941 was achieved with 87,000 tons.

Nearly 18,000 tons of urea were made at the new urea plant, which promises to be an important dollar earner; the U.S.A. requires 6000 tons, worth $750,000. A target of 400,000 tons for the sulphate plant was reached on the last day of 1949.

The Casebourne Works produced 270,907 tons of cement and Cassel Works, part of the General Chemical Division, increased production in a wide range of chemicals.

Eastern Industrial Development

INDUSTRIAL development in the Middle East and Far East comparable with the industrial revolution in this country a hundred years ago and affecting 1500 million people in the next half century was forecast by Mr. H. E. Alcock, managing director of Alcock (Peroxide), Ltd., in his presidential address to the Luton and District Chamber of Commerce last week. In those areas living conditions had made little or no advance in the last 2000 years, he said.

The U.S.A. and Western Europe were more or less parallel with Britain in industrial development and therefore in competition with us in supplying goods to the Middle East and Far East during their development, which might well take another 50 years. Fortunately there were indications that co-operation between the U.S.A., the Commonwealth and Western Europe was making some progress. This, however, did not mean that we could afford to relax for one moment in our efforts to produce more at a cheaper price by more efficient methods, to export more at a competitive price in order to pay for our essential imports, added Mr. Alcock.

THE STRUCTURE OF MATTER

Practical and Theoretical Advances

AN endeavour to establish the existence of a number of elementary particles which could be regarded as the basis of all matter made up, has always been one of the basic aims of physics. All natural phenomena should be explicable in the last analysis in terms of the properties of these particles, said Prof. J. C. Gunn, Cargill professor of natural philosophy, Glasgow University, in his recent address on "Fundamental Particles" to the Royal Philosophical Society of Glasgow.

Great progress had been made in the last 50 years in this research, which was now perhaps nearing its culminating point, the professor continued. Upon this the theoretical and the experimental research programme of the natural philosophy department of Glasgow University had been based.

Practical and theoretical advances had been inextricably mingled in the discovery of the five groups of particles at present known.

The second great new theoretical principle had been the special relativity of Einstein, which served to limit the possible wave equations that could be used to describe the elementary particles. It was a remarkable fact that some of the simplest mathematical schemes derived in that way actually described correctly most, if not all, of the properties of the known elementary particles.

The X-Ray Microscope

A NEW instrument, an X-ray microscope, is being developed by scientists of the (U.S.) General Electric Company. It does not require samples under study to be in a high vacuum, as does the electron microscope, and because of this, the company hopes it may be possible to examine living materials at much higher magnifications than before.

Clear, sharp X-ray images, magnified ten times, are claimed to have been produced and these have again been magnified ten times by photographic enlargement without serious loss of detail.

The microscope consists principally of an X-ray tube and a pair of curved mirrors (platinum coated quartz), which the X-rays strike after having passed through the sample. The mirrors, acting in the manner of a convex lens with a light beam, bend the rays so as to form a magnified X-ray image of the sample on a photographic film.

Report on Chemical Industry

ABCM's Revealing Study of Sources of Basic Supplies

THE completion of probably the most far reaching attempt to present in an assimilable form all the essential facts about the structure, present scope and future prospects of chemical producing industries in this country was signalised by the release this week of the Report on Chemical Industry, 1949.

This, collated and very lucidly presented by the Association of British Chemical Manufacturers, represents the association's response to the request made to it in September, 1948, by the President of the Board of Trade for a " survey of the whole of the chemical industry " and of the detail and general direction of future development. The President indicated that one of the objectives of such a survey would be to heighten the industry's own appreciation of the best means of securing the objectives described in the report.

These facts are now recalled in the preface to the completed report, which occupies 75 pages and a chart of the principal products of the British industry, and it is made clear why the association decided to provide something much fuller in its scope than what was asked for. Because of the interrelationships between various branches of chemical production and their direct links with other industries, no treatment of chemical industry as a complete entity is possible. It has, as the report observes at the start, never been clearly defined.

Scope of the Report

It was agreed, after discussion with the President of the Board of Trade, that the field to be covered should be heavy chemicals, industrial gases, fertilisers, dyestuffs, medicinal and other fine chemicals, explosives, plastics and synthetic resins, but not the compounding of chemicals to make such products as paints, insecticides, sheep and cattle dips and pharmaceutical preparations. Synthetic fibres and rayon are not included, but the chemical raw materials used in their manufacture are considered in the appropriate places.

Notwithstanding the statistical value of the 16 chapters which precede it, much of the interest of the report is contained in the final chapter " The Future of Chemical Industry " in which the import of much that is recorded earlier is interpreted and commented on authoritatively. Here also is made clearer the part of chemical producing industries in the general economy and some of the factors, beyond their control, which tend to impede the full development of undertakings depending more than almost any other upon private initiative and spending on research proportionately a larger sum than is given to chemical research in the U.S.A.

The ABCM's observations in the final chapter are in these terms :—

The primary object of this report has been to ascertain whether the plans of the British chemical industry are adequate to the part it has to play in the national economy. It is considered that the data recorded, and the various proposals outlined, make it possible to answer this question in the affirmative.

Willing Co-operation

Most of the information (in Chapters V to XVI of the full report) results from an inquiry by the ABCM of its own members, of members of the allied associations (The British Colour Makers' Association, British Sulphate of Ammonia Federation, Ltd., National Sulphuric Acid Association, Ltd.) and of other firms believed by the Board of Trade or the Ministry of Health to be engaged in chemical manufacture.

Of more than 500 firms approached, over 200 were found not to be engaged in chemical manufacture as defined. Only 22 failed to reply; a number of these are believed not to be engaged in chemical manufacture and 15 of them were not members of the co-operating associations. Together, the 22 firms represent less than 1 per cent of the industry's capital, labour and output.

Detailed replies were received from 272 firms, and it is clear that the facts and figures given in this report accurately reflect the industry's activities. The association appreciates very much the confidence shown by all the firms who have given the information, much of it of a private nature.

These replies have afforded full information about the industry's plans for rehabilitation and expansion and the expenditure to be incurred in giving them effect, about the numbers of staff and operatives in various categories, and about many other matters, some of them highly technical; in addition, details were supplied

* " Report on the Chemical Industry," the Association of British Chemical Manufacturers, 166 Piccadilly, London, W.1. ; 5s.

about the amount of capital employed by each firm—all these data applying to the chemical industry as defined for the purpose of this report.

The capital employed is defined in the manner usual in accountancy, that is to say, it includes issued capital, debentures and loans, with all sums designated capital or revenue reserves for the purposes of the Companies Act, 1948, but less investments other than trade investments. On this basis the total capital employed in the industry at the end of 1948 was £230,637,000.

Labour Employed

In Table VIII the firms have been arranged in groups according to the number of persons employed. It shows the number of firms in each group and their percentage of the total number of firms. The table also includes the corresponding figures, taken from the *Ministry of Labour Gazette*, for the chemicals, explosives, oils, paints, etc., group of industries, and for industry as a whole.

The figures, as recorded in the *Ministry of Labour Gazette*, for industry as a whole and those for the chemical group of industries, are very similar in pattern, but are markedly different from those for the chemical industry as covered by this report, which show a much higher proportion of labour employed by a small number of large firms.

In Chapter I of this report, it is made clear that only the manufacture of chemicals is under consideration, and not their further preparation before sale, whether that involves simple operations like the preparation of compound fertilisers by the mixing of solid powders, or more complex activities, such as the making of paints and lacquers. In point of fact, there are very few firms, if any, exclusively engaged in manufacturing chemicals. Almost all those so engaged also use chemicals to prepare further products by operations that are not themselves chemical within the terms of the present definition, although chemical compounds may well be the most important, if not the only ingredients of the products so made.

To provide the information for which the ABCM asked, the firms replying in detail had to dissect their use both of capital and of labour, so as to include only that proportion employed in the manufacture of chemicals. This has clearly involved an intricate analysis of each firm's activities and the association recognises fully the trouble taken by all of them to ensure that the information returned was as accurate as possible and also related solely to the manufacture of chemicals.

Production Capacity

Thus the information contained in this report does not refer to the total activities of the firms concerned, but only to a part, and to a part that varies greatly from firm to firm. It must be borne in mind that all figures considered here do not relate to the total activities of the aggregate of firms covered, but solely to their activities in the chemical industry as defined, an industry that has no separate physical existence. This fact may well account in part for the abnormal frequency distribution of its size groups.

The most recent figures available for true production are those contained in the partial census of production carried out by

TABLE VIII

COMPARISON OF A B C M AND MINISTRY OF LABOUR FIGURES FOR COMPANIES GROUPED ACCORDING TO NUMBER OF EMPLOYEES

	A B C M Figures				Ministry of Labour Figures for Chemicals, Explosives, Oils, Paints, etc.				Ministry of Labour Figures for all Industries			
	1	2	3	4	1	2	3	4	1	2	3	4
	No. of Companies	No. of Companies (Col. 1) as Per Cent of Total No. of Companies	Total No. of Employees in Companies in Col. 1	No. of Employees (Col. 3) as Per Cent of Total Employees in all Companies	No. of Companies	No. of Companies (Col. 1) as Per Cent of Total No. of Companies	Total No. of Employees in Companies in Col. 1	No. of Employees (Col. 3) as Per Cent of Total Employees in all Companies	No. of Companies	No. of Companies (Col. 1) as Per Cent of Total No. of Companies	Total No. of Employees in Companies in Col. 1	No. of Employees (Col. 3) as Per Cent. of Total Employees in all Companies
0–10	31	11.5	206	0.15					No figures given			
11–24	49	18.3	861	0.60	648	27.6	11,000	3.1	15,640	30.6	262,000	4.0
25–99	89	33.2	4,748	3.35	988	42.1	50,000	14.2	22,440	43.9	1,129,000	17.4
100–499	61	22.8	13,711	9.7	580	24.7	120,000	34.1	10,730	21.0	2,229,000	34.2
500–999	20	7.5	13,832	9.7	78	3.3	52,000	14.8	1,330	2.6	908,000	13.9
1000–1999	12	4.5	17,891	12.6	30	1.2	41,000	11.6	590	1.2	801,000	12.3
2000 and over	6	2.2	90,568	63.9	18	0.7	77,000	21.9	310	0.6	1,181,000	18.1
Total	268	100.0	141,817	100.0	2,342	99.6	351,000	99.7	51,040	99.9	6,510,000	99.9

the Board of Trade in 1946. This gives for the industry's products a value of £212 million. Since that date the industry has expanded considerably; on the other hand, the Board of Trade definition is wider than that adopted in this report but it omits fertilisers and explosives.

The nearest estimate to be safely made is that the industry, as defined in this report, probably produced in 1948 chemicals to the value of at least £250 million, though production capacity at the end of 1948 was £347 million.

At that date, 142,000 employees utilised a total capital of £231 million with an annual production capacity of £347 million, whereas according to forward plans only 25,000 additional employees will be required to operate new capital expenditure of £191 million, with an additional production capacity of £223 million. Expressed per employee, this is as follows:—

	Per Employee	
	Capital	Production Capacity
	£	£
Existing plant	1,600	2,400
Additional plant	7,600	9,000
Overall existing and new plant	2,500	3,500

These figures cannot be the result of exact computation and are subject to a number of qualifications. Compared with new expenditure, the capital employed in existing plants is assessed much too low, for it computes plant now installed at "book values," that is, original values—often pre-war—less depreciation and these are far below replacement values. On the other hand, it also includes capital locked up in stocks of raw and finished goods, together with any excess of debtors over creditors.

Capitalisation

No available information allows a suitable correction to be made; in terms of today's values, it seems likely that the real capital employed in the industry is under-estimated by £150 million to £250 million. Again, it should be pointed out that the capacity to produce is based upon product values at the end of 1948 and these may not persist. Accepting that the figures are of necessity only rough estimates, the effects of the movement towards greater mechanisation, larger plant units and continuous processes (to which more detailed reference is made) are clearly shown by the marked increase in the ratio both of new capital and of new production capacity to manpower.

That the volume of production of the industry has been steadily increasing there can be no doubt. Evidence of this is available from various sources. Comparison of the figures for the chemical, dyestuffs and drugs trades contained in the 1935 Census of Production with the 1946 partial Census of Production is made in the preliminary report No. 4 on the latter. To permit direct comparison, the figures for 1946 have been converted to 1935 values by using ratio given verbally by the Board of Trade of 100 (1935) to 200 (1946) in the following table:—

TABLE IX

OUTPUT OF THE CHEMICALS, DYESTUFFS AND DRUG TRADES—PRIVATE FIRMS

Values in £'000	1946 Value	1946 Converted to 1935 Values	1935 Value
Production (gross output)	212,217	106,108	65,642
Materials, fuel and electricity used	116,744	—	30,849
Net output	94,456	47,228	34,038

The above figures support the Index of Industrial Production compiled by the London and Cambridge Economic Service, which indicated that the output of the chemical and allied industries in 1946 exceeded that of 1935 by almost one-third. The same service estimates that the year 1948 showed a further increase of 17 per cent over 1946. Confirmation of this estimate is to be found in the Interim Index of Industrial Production published by the Central Statistical Office, which puts production for the "chemical and allied trades" in 1948 at 20 per cent above that in 1946.

Greater Output

The forward plans for the industry provide for a further increase in production capacity of 70 per cent during the five years from the end of 1948. Making allowance for tentative schemes that may not come to fruition by 1953, there are reasonable grounds for believing that the rate of increase in production attained during 1947 and 1948 will be maintained for at least the next three years. In 1951 the output of the industry should be 50 per cent greater than in 1946.

There are not available adequately detailed statistics dissecting chemical imports in such manner as to make possible a strict estimate for the chemical industry as defined by this report. Useful indications can, however, be obtained from Class III, Group O—Chemicals, Drugs, Dyes, and Colours—in the Trade and Navigation Accounts. Under this heading the value of imports and re-exports has been as follows:—

Value in £'000	1938	1946	1947	1948
Value of imports ...	13,613	17,789	26,719	31,402
Value of re-exports	463	791	647	781

The large increase in value of imports between 1938 and 1948 is solely due to

increase in prices. When the appropriate adjustment for price increase (1938, 100; 1948, 233) is applied, the volume of imports in 1948 is found to have been slightly less than in 1938.

Some chemical imports also occur in Class III, Group U (Plastics). When these are added, the retained imports for 1948 were £35,496,000, of which the main items were as follows:—

	Value (£'000)
Potassium compounds	7,085
Extracts for tanning	3,163
Carbon blacks	2,700
Fertilisers (superphosphate, etc.) ...	2,224
Casein	2,003
Other plastic materials	1,738
Ethyl alcohol	1,532
Celluloid	1,134
Synthetic organic dyestuffs	1,015
Chemical manufactures unenumerated	6,886
	29,480

The main sources of these imports were U.S.A. (£12 million) and Germany (£5 million); the balance was spread widely among many other countries.

Limiting Imports

Imports of chemicals fall into two main categories:—

(a) raw materials or the products of raw materials available overseas but not in this country;

(b) manufactured products made in the U.K. in insufficient quantity or not at all.

In general, there are no alternatives for the first group and such importations must continue.

There is, however, one very important possible exception to this, affecting the largest single import—potassium salts. There are indications of rich deposits of potassium salts in Yorkshire. These are, however, of such nature and at such depth as to present great engineering and other technical difficulties, though there is reason to believe that these may be overcome. It must, however, be some years before this enterprise can be brought to successful commercial production and continued importation of potassium salts is thus temporarily unavoidable.

During the past year the ABCM has made a detailed study of chemical imports falling within the second group; so far as the limited available statistics permit any conclusion, it appears that a very substantial part of the avoidable imports will be replaced by home manufacture, with a considerable saving in dollars, as soon as the schemes of expansion now in progress have been completed.

Certain imports, however, reflect special concessions made by the U.K. Government when negotiating trade agreements with foreign countries, sometimes without consulting the industry. Examples of this are recent imports of benzene hexachloride and also of certain dyestuffs, for similar products were being manufactured in the U.K. on a scale adequate to meet the domestic demand at reasonable prices. The need for close consultation with the industry is emphasised, if its forward plans are fully to materialise.

When all schemes for expansion are completed, the manufacturers forecast a reduction of imports by £28 million. This figure is probably too high, owing to some duplication of import saving anticipated by different manufacturers operating in the same field; nevertheless, a reduction of imports by one-half is a conservative estimate.

The Trade and Navigation Accounts (Group III (O)) give the figures for exports (excluding re-exports) thus:—

	1938	1946	1947	1948
Value in £'000's ...	22,280	66,086	67,426	83,670

When corrected for change in value, 1948 exports represent an increase of 56 per cent by volume over 1938. The export target set by the Board of Trade for the end of 1948 was £8.05 million per month, but the industry fell a little short of this target (December £7.347 million). This was probably due to the increased demand at home for chemicals needed in the manufacture of other exportable goods of higher value, which have a prior claim over the direct export of chemicals.

Export Markets

The distribution of these exports (which exclude plastics) is very wide. The principal markets were India and Pakistan, which together took 13 per cent of the total chemical exports in 1948, Australia 6 per cent, South Africa and Argentina each 4½ per cent. About one-half of the exports went to Commonwealth countries. Outside the Commonwealth our best customers were Argentina, Sweden, Egypt, U.S.A., France, Netherlands and Iran in decreasing order of value. Plastics exports (Group III (U)) were £4,710,000 in 1948.

Exports to U.S.A. present special difficulties. There is in the United States a highly developed chemical industry, protected by an import tariff and having access to an abundance of most raw materials. Chemical exports from the U.K. to U.S.A. have mainly been of basic products in short supply—notably coal tar distillates.

It would perhaps be unrealistic to anticipate any large increase in the export of chemicals to U.S.A.; the reduc-

tion of U.S. imports into the U.K. will be a more pronounced feature of the industry's future development. Nevertheless, every endeavour is being made by the industry not only to maintain but to raise the present level of exports to the U.S.A., more particularly in certain specialised products that have been developed in this country.

The prospects in countries in the dollar area with little or no domestic chemical industry are more promising and these markets are receiving close attention. It should be added that in some countries and notably in the U.S.A., there are also possibilities of earning dollars from licensing under patents and the sale of "know-how."

Though a total increase in exports of £49 million, including plastics, is possibly an over-estimate, a very considerable increase is reasonably to be anticipated as the industry's plans progress. The greater use of chemicals in many of the developing countries abroad reflects an overall rise in the standard of living. This may only be attained slowly, but its effect upon the demand for chemical products must be profound and lasting.

[*The section of the original report which followed here has been omitted, as being confidential to the Board of Trade.*]

Adequacy of Industry's Plans

Within the heavy inorganic chemical groups it is possible to forecast overall requirements with some accuracy. There is a long user history—50 to 100 years—showing a steady increase in demand little affected by trade cycles or fluctuations. Expansion of production has been planned in the light of this knowledge and, when the schemes now in progress have been completed, there should be ample capacity to meet normal demands for some years and such fluctuations as past experience indicate to be likely. In both groups the projected increase in capacity is about 50 per cent.

The production of fertilisers in the U.K. has been under constant review by the Ministry of Supply and other Government Departments, in consultation with the manufacturers concerned. Since the end of hostilities the industry has itself given continuous attention to the problems of further expansion in fertiliser production. Manufacturers have had to consider two sets of forces that must affect home and overseas demand respectively, both for nitrogenous and for phosphatic fertilisers.

In the first place, the Government has declared its views on the expansion of agriculture in the U.K. The industry has accordingly planned for such increases in productive capacity as will make it possible to meet the large increase in the home use of fertilisers that must follow implementation of the Government's policy. The plans are indeed already in course of execution and it is clear that they should, when completed, enable the industry to cope completely with the increased nitrogen and phosphate consumption envisaged by the Ministry of Agriculture.

Prospects for Fertilisers

In the second place, vast changes in the world markets may reasonably be anticipated. Among the new factors to be taken into account are those activities of the Food and Agricultural Organisation of the United Nations that are specially directed to encouraging among member nations, especially those whose populations are living at low subsistence levels, an increase in their use of fertilisers of all kinds. It is to be hoped that the advice of FAO supplementing the irresistible pressure of circumstances, may not only lead to the desired increase, but may also encourage the governments of many countries to declare in detail their agricultural policies.

These declarations will make it possible to estimate on a basis of something more than guess-work what are likely to be the world's needs for increased nitrogen fertilisers and therefore the extent to which the U.K. industry can make an increased contribution to them with due regard to the production plans of other countries.

The first report of the Committee on Industrial Productivity (Cmd. 7665, para. 64) has specifically called attention to the present world shortage of nitrogenous fertilisers and recommends that urgent consideration be given to providing additional production capacty. The increases at present planned in production of fertilisers should enable the British chemical industry not only to cope with home demand, but also to satisfy Colonial needs and at least to maintain a footing in other export markets.

It must, however, be remembered that to meet a large increase in requirements for nitrogen fertilisers abroad, particularly in markets outside the Commonwealth, new capital investments will be needed. The decision to undertake them will depend both on an assessment of purchasing power in possible markets and on the level of exportable surpluses foreseen as likely to become available from other countries producing nitrogen fertilisers. There are indications that plans for increased production outside the U.K. will in a short time lead to substantial additional quantities for export.

The progress of modern industrial chemistry is particularly reflected in the production of heavy organic chemicals and to a lesser extent in the pharmaceutical and fine chemical groups. Here the heavy capital expenditures already in hand and projected arise largely from the development of the production from oil of many diverse organic chemicals. The schemes, when completed, should virtually remove the need to import from U.S.A. and should also add very substantially to exports.

Soap Substitutes

A particularly important expansion in this field is that of synthetic detergents. Not only are these products of great practical value in themselves, but their use reduces the demand for soap and thus helps to ease the call on the world's continuing inadequate supply of fats and vegetable oils.

The plastics industry is developing rapidly; indeed, its development may temporarily be in excess of requirements, but the utility of its products seems fully to justify its long-term programme.

The possibility of an unnecessary and therefore undesirable degree of expansion within the chemical industry has not been overlooked and in one or two instances it has appeared that contemplated production might be in excess of ultimate requirements.

While in this report it has not been possible, owing to the confidential nature of the plans submitted, to assess them in detail and while precise prediction of future demand is impossible, the result of the ABCM's inquiry and the study of the information supplied do not suggest any serious danger of wasted effort arising from the industry's present plans.

On the assumption that the plans of the industry for rehabilitation and expansion are accomplished with promptitude, and subject to the reservations about sulphuric acid, so far as can be foreseen it is believed that the industry will prove equal not only to meeting fully the needs of the home market but to eliminating avoidable chemical imports, while also providing a large increase in exports.

Vigour and Courage

" So far as can be foreseen " are, however, words of great importance in the chemical industry, which, possibly to a greater extent than any other, is liable to be affected fundamentally by new discoveries as well as by the general advance of scientific knowledge. What evidence is there that the industry has within itself the resources, vigour and foresight not only to meet the foreseeable future, but also to maintain its position in the longer term?

The industry is now spending on research £8.5 million annually and proposes to expend £11.4 million annually when projects for additional research facilities, involving capital expenditures of more than £8 million are completed.

It is unlikely that this large expenditure on research is exceeded in any other industry; it compares well with corresponding figures in other countries—for instance, in U.S.A. The figures speak for themselves and reflect the initiative believed to characterise the industry.

Courage is an essential element in the expenditure of large sums upon research, the outcome of which may be the evolution of new processes and products replacing those upon which large expenditures are even now being made.

Taxation and Controls

Financial strength to meet such circumstances is a necessity if the industry is to maintain its position in oversea markets in the face of international competition. Taxation at the present levels imposes a severe handicap upon the accumulation of adequate reserves for obsolescence, for which the increased initial allowances provide insufficent alleviation.

During the past decade the chemical industry, in common with many others, has felt the adverse effects of the many Governmental controls. While the need for control of industry by Government during the war is not questioned, the long continued extension of controls, the strict limitation of imports and the existence of a sellers' market—fostered in some degree by bilateral trade agreements—has tended to discourage free competitive initiative, which will again be vital to success as the buyer once more exercises discrimination.

These factors have affected the chemical industry as well as others and the question may well be asked whether, in the face of competition in overseas markets, particularly from U.S.A. and Germany, the chemical industry can, in fact, secure the large increases in export trade for which it plans.

The action that the industry is taking will, it is believed, result in production costs that are internationally competitive, but this alone will not secure exports. There is also needed personal contact with the buyer and first hand knowledge of his local problems, coupled with provision of that technical service to the consumer which has been developed in the home market. For these purposes a wide

(continued on page 190)

THE CHEMICAL "IMPROVEMENT" OF FOOD

Medical Council's Case Against Agene

A COMMENTARY on the considerations which were among those which influenced the Ministries of Food and Health to support a recommendation for abandoning the use as a bleaching agent and improver in flour of nitrogen trichloride is contained in the current report (for 1945-48) of the Medical Research Council.

The council comprises this and some associated topics under the general heading "The Sophistication of Food" and observes that the preparatory treatment of ingredients of diet by chemical substances, either to make them more palatable or to preserve them, has become a very extensive practice in western civilisation. In the case of some foodstuffs of importance, equal to milk and butter (to which no chemical addition is permitted) considerable licence is allowed to manufacturers to add chemicals in order to increase the palatability or the keeping qualities of the products, says the MRC.

One of the outstanding articles of consumption in this category is flour and, indeed, cereals in general. In this country flour for human consumption may have been "improved" by treatment with oxides of nitrogen, benzoyl chloride, chlorine dioxide, potassium bromate, nitrogen trichloride or "agene," and ammonium persulphate.

The chemical treatment of such foods makes them lighter in texture and in colour, and more easily masticated.

Toxic Action in Animals

The subject has recently become of greater interest (the report continues) owing to the discovery of a dramatic toxic action, in some animals, of bread made from flour which has been subjected to the "agene" process. Flour is mixed with the gas nitrogen trichloride, and the result is that the flour is bleached and its protein so altered that much larger loaves of a whiter colour and lighter texture can be made from the same weight of flour.

Lest it be thought that this is only an occasional incident in food preparation, it may be added that there is reason to believe that about 90 per cent of all the flour consumed by the population in this country is so treated, and that a similar figure has probably applied until recently to the bread eaten in the United States. The question whether there may be even remote ill effects on human beings from the continued consumption of flour so treated is clearly of great importance.

The report then instances the incidence of canine hysteria and of epilepsy of dogs here and in the U.S.A. and says that it has now been shown that canine hysteria can be caused by the consumption of bread or dog biscuits made of flour which has been treated by the agene process. The most susceptible discovered up to the present are dogs and ferrets, but other animals, such as cats and rabbits, can be similarly affected if the amount of flour they eat has been treated sufficiently intensively with nitrogen trichloride. Monkeys also, although not giving the same gross signs of toxicity, have been found to respond by exhibiting electro-encephalographic reactions typical of epilepsy.

Effects on Humans

Tests were accordingly started on both sides of the Atlantic to see whether any detrimental effects of the treated flour could be observed in human beings. Up to the present, in short-term studies of persons eating bread made from treated and untreated flour, it has not been possible to demonstrate that the former has any acute ill-effects in man. On the other hand, it is more difficult to detect toxic action of a chronic and less dramatic nature, and this remains a real possibility although it has not yet been detected.

Even if scientific research cannot relate the consumption of agenised bread to any known harmful effects in man, there seems a good *prima facie* case for abandoning a method of flour "improvement" which is known to be associated with the production of serious and often fatal disease in animals.

On the other wider question, it is clear that here is a warning, not to be disregarded, on the possible dangers associated with the chemical treatment of food; and it is to be hoped that in the future a much closer watch will be kept on all such methods, and that scientific work will be directed to the detection of possible harmful effects produced by chemical agents which at first sight may seem innocuous.

C

Beryllium Hazards in Industry

Work of the Toxicology Research Unit

THE toxicity of beryllium was one of the first scientific problems to be studied by the Toxicology Research Unit, Porton, Salisbury, established by the Medical Research Council early in 1947.

The report of the unit's experimental investigation of toxicological problems, with special reference to industrial hazards is contained in the Report of Medical Research Council, 1945-48 (Cmd. 7846).

Contrary to earlier reports from the U.S.A., it has been shown that beryllium in the form of its soluble salts has a high degree of specific toxicity. A satisfactory method for the microdetermination of beryllium in body tissues was developed after considerable difficulties had been overcome.

The acute liver necrosis that follows the intravenous injection of small doses of beryllium salts has been shown to depend on a rapid focal concentration of the metal within the liver; it is this liver necrosis that causes death in such cases.

Malignant bone tumours have been produced in rabbits by injecting the chemically insoluble beryllium silicates—a finding which confirms earlier American work.

In 1947, deaths among workers spraying fields with dilute solutions of dinitro-*ortho*cresol, used as a weed killer, led to a demand for more knowledge about the toxic effects, of this compound, which was known to stimulate metabolism.

Experiments with animals have shown that its toxic action is an acute one, and there is no evidence either of a cumulative effect or the development of tolerance. High environmental temperatures raise the death-rate of animals exposed to its action.

An attempt is being made to follow the metabolism of dinitro-*ortho*cresol, in the hope of being able to detect the excretion products in the urine by a simple reaction.

More recently, work has been started on the toxicity of the new organic phosphorus compounds which are being manufactured and distributed as insecticides. Many of these compounds are known, and their toxicity to mammals and insects varies very widely, although their action in general appears to be similar. Their toxicity by inhalation and by ingestion is being examined and an attempt is being made to learn more more about the disturbances they produce in the body.

The need for a comparative study of the efficiencies of various types of sampling apparatus was emphasised in the report from groups for research in industrial physiology at the London School of Hygiene and Tropical Medicine (Special Report Series No. 244).

A critical investigation of this nature has been undertaken by Mr. C. N. Davies; a satisfactory technique for obtaining a standard cloud of coal dust, with particles ranging from 1 micron to 10 microns in size, was perfected, and this is being used to test the sampling efficiency of different instruments.

Theoretical work on the impingement of dust is also being carried on. A study of fibrous dust filters has been made, and a note on resistance characteristics published.

REPORT ON CHEMICAL INDUSTRY

(*continued from page* 188)

extension of oversea services and oversea companies acting as the spearheads of British chemical manufacture will be increasingly called for.

In pursuance of these aims, the industry must co-operate with the nationals of other lands. For this purpose there is necessary not only a rapid relaxation of the various restrictions on oversea operations suffered by British chemical industry, but also the maintenance by that industry of methods and organisation that will make it an acceptable partner to oversea associates.

In conclusion, those responsible for this report are convinced that in this immensely complicated industry, or series of industries, in which the threads of chemical science are woven into so many and so intricate patterns, and which is, as has already been said, a continuous venture into the unknown, an industry which has its contacts and associates in many lands and which both at home and abroad is intimately bound up with a wide network of marketing organisations, the national purpose will best be served by the utmost freedom of enterprise, and that only thus can the plans which are outlined in this report bear full fruit.

Drugs and Fine Chemicals in 1949—II

The Search for Cortisone

by G. COLMAN GREEN, B.Sc., F.R.I.C., A.M.I.Chem.E.

THE search for suitable plant sources of raw material of cortisone is being prosecuted on a scale commensurate with the importance of what may be wrested from this brand of research. American and British teams are in the tropics studying likely flora. A British expedition, which includes a botanist from Kew, is reported to have been flown to Nigeria (*Chem. and Drug.*, 1949, November).

Marker & Applezweig (*Chem. and Eng. News*, 1949, *27* (16), 3348) have surveyed steroidol sapogenins as a possible source of suitable cortical steroids. They point out that the search is basically for steroids with substituents in ring C of the steroid nucleus. Such sources are presented by the bile acids; digitalis glycosides (which would yield only minute amounts); sarmentogenin isolated in uncertain and variable amounts from the exotic vine already referred to: jervine—the alkaloid of veratrum, of which the chemical structure is still in doubt.

Yield of Sapogenins

They indicate that, by contrast, sapogenin-bearing plants are widely spread and acclimatised to temperate conditions in the wild state. Yield of sapogenins as high as 10 kg. per ton of plants are claimed to be obtainable.

Marker has studied exhaustively side-chain isomers of some of these sapogenins, including botogenin, referred to above, and some of these have been converted to the corresponding 16-dihydropregnane derivatives, via the corresponding *pseudo*-sapogenins. Of these sapogenins it is claimed that botogenin is the most readily convertible into cortisone since the required ketone is produced merely by oxidation.

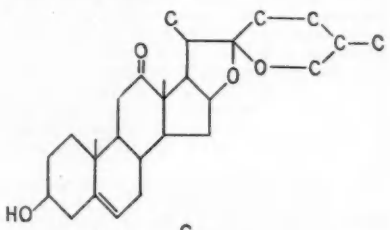
R. R. Williams (*Chem. Eng. News*, 1949, *27* (47), 3516), commenting upon the above suggestions, regards these proposals as highly suggestive, but too optimistic.

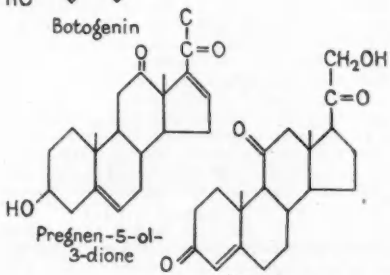
To present an idea of the magnitude of the problem, he points out that the soya bean is widely in cultivation, yet the stigmasterol from the whole of the U.S.A. crop would be insufficient, on any reasonable assumptions regarding conversions, even if a good method were available for introducing the desired oxygen into the C ring.

Marker has also summarised the problem elsewhere (*J. Amer. Chem. Soc.*, 1949, *71*, 2656). The fundamental objective is to introduce a ketonic oxygen at C11; but no sterols with such an arrangement are known to occur in nature in large quantities. The reason for using bile acids at present as raw material is that a hydroxyl group can readily be introduced into the desired position (Marker and Lawsen (*J. Amer. Chem. Soc.*, 1938, *60*, 1334).

Synthetic Production

The production of cortisone (11-dehydro-17-hydroxy-corticosterone) from this intermediate gives low yields at two particular steps, one of which is associated with the elimination of the side chain and the other with the introduction of the double bond in ring A. Marker sets out in this paper details of the various synthetic steps leading from the naturally occurring botogenin to pregnen-5-ol-3-dione-12:20-acetate, which is now to be regarded as a starting material for cortisone with ketonic group at C-12 and the double bond in the desired position:—





Marker has for many years been a leader in the field of sapogenin chemistry and was the first to characterise botogenin (*J. Amer. Chem. Soc.*, 1947, 69, 2397).

Sir Robert Robinson (*Nature*, 1949, *164* (4181), 1029) in his anniversary address to the Royal Society has made an estimate of the prospects for cortisone synthesis. His view is that the partial synthesis from sarmentogenin (and, presumably by implication, from botogenin) is too long for the type of production required. He considers that there are three promising lines of exploration, which are:—

1. Total synthesis.
2. Synthesis of an effective analogue.
3. Synthesis of a substitute.

In respect of the third suggestion, he thought this might follow the lines that the anterior pituitary gland (otherwise the *hypophysis cerebri*, a small gland the size of a pea, lying on the underside of the third ventricle of the brain and responsible for the control and development of other endrocrine glands) produces an adrenocorticotropic hormene (ACTH) which stimulates the adrenal cortex to secrete its own cortisone.

In fact, the administration of ACTH has also been a means of alleviating the symptoms of rheumatoid arthritis, and, in common with cortisone, has given dramatic relief so long as injections are continued; remission occurs as soon as administration is discontinued.

Peptide Synthesis

Li, at the First Congress of Biochemistry in 1949, announced that he had found that a partial hydrolysate of ACTH contained a peptide with a small number of amino groups which showed an activity similar to ACTH. Sir Robert suggested that it might be found that the synthesis of such a substance as this peptide might be found practicable on a fairly large scale.

The possibility of finding an equally effective compound but of a structure simpler than ACTH is being explored by the Rheumatism Research Department of the Manchester Royal Infirmary.

ACTH, itself, is almost as scarce as cortisone. It has been estimated that the anterior pituitary glands from 40,000 pigs would be required to yield 1 lb. ACTH.

It is an interesting point that patients who are suffering from adrenocortical insufficiency can still be forced to secrete adequate supplies of natural cortisone when given injections of ACTH. The nature of the lesion by which the patient fails to secrete cortisone naturally from the adrenal gland is, at present, quite unknown. An interesting biochemical/physiological field is obviously being opened up. In order to obtain an approximately equivalent effect to cortisone in the relief of rheumatoid arthritis, it is necessary to inject 25 mg. ACTH three times per day.

Spies, of the Chicago Medical School, who will be remembered for his chemical work and publications on folic acid, has now contributed studies on substitutes for ACTH and cortisone (*Lancet*, 12/11/49, 980; *ibid*, 7/1/50, 11). He has studied the effect of a series of steroids to ascertain whether or not they have any ACTH-like action. This latter may be conveniently measured by the effect of the injection on the number of circulating eosinophils in the blood.

Eosinophils are cells normally occurring in the blood and readily stainable with eosin. ACTH causes a fall in eosinophil count in normal individuals. The steroids tested were reasonably accessible and were all structurally related to cortisone. They were:—

1. Pregnene-4-triol-(17α, 20β, 21) one-3-diacetate.
2. Pregnane-3:12:20-trione.
3. 17-methyl-Δ^5-androstendiol-3(β):17(α).
4. 17-α-hydroxyprogesterone
5. 17-α-hydroxydesoxycorticosterone-21-acetate.
6. Desoxycorticosterone acetate.
7. Ergostanyl acetate.

None of these substances caused any decrease in circulating eosinophils. Similarly, none of these substances had any effect on the progress of rheumatoid arthritis. What stands out, therefore, is that the effect of cortisone is very specifically related to its structure.

(*To be continued*)

New Industrial Films

AMONG recent additions to the library of the Petroleum Films Bureau is "Pattern for Chemicals," which shows briefly how the Shell Petroleum Company utilises refinery gases derived from cracking and the part played by the chemist and chemical engineer in constructing the new by-product substances.

"New Detergents," another film produced by Shell, explains how detergents of increased efficiency are being made from petroleum wax.

Both are sound films and obtainable (in 35 mm. and 16 mm. gauge) to a wide variety of educational and industrial organisations on application to the Petroleum Film Bureau, 29 New Bond Street, W.1.

Metallurgical Section

Published the first Saturday in the month

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4 February 1950

STEEL ACHIEVEMENT AND OUTLOOK

Production Target Again Raised

WORLD steel requirements declined during 1949, and this was reflected to some extent by a reduction in output in many countries—notably Belgium and the U.S.A.

In Britain the change was less obvious, but the industry had to adapt itself to new requirements, the main tasks being to achieve greater production and low price. Both these were achieved, output reaching the highest figure ever attained and exceeding the upper limit of 15.5 million tons estimated in the Economic Survey of 1949, while prices were among the lowest in the world.

How this was accomplished and the prospects for this year are described in the recent issue of the British Iron and Steel Federation's *Monthly Statistical Bulletin* (Vol. 24, No. 12) which reveals that production plans for 1950 propose to add some 250,000 tons of steel, to provide a total of about 15.75 million tons.

This observes that the flow of raw materials to the industry during the year proved, in the end, to have been better than had at one time been expected. Particularly was this so of imported iron ore and imported scrap. Such deficiencies as there were could be attributed largely to two factors—strikes in the North African ore mines and the usual seasonal shortage of vessels, aggravated by a North American shipping strike.

Satisfactory Stocks

From the Spring onwards, with the opening of the Baltic ore ports, the situation improved rapidly. By the last quarter it became clear that the year's target would be reached, and stocks are now at a more satisfactory level.

As for the future, the prospects have been made all the more uncertain by the devaluation of the pound, the full effects of which have yet to make themselves felt.

Supplies of both coal and coke to the industry during the year were adequate. The quality, however, left much to be desired; especially was this so of blast furnace coke. The introduction of larger and more modern furnaces had made it imperative that quality be maintained.

As the most important industrial consumer of coal, the steel industry also saw the average price of coal raised on May 30, 1949, by 7d. a ton, that of coking coal by 6d., and that of blast furnace coke by 1s. 9d. These increases were not passed on to the consumer.

Economics and Development

The re-equipment of the industry, as projected in the development plan approved in its broad outlines by the Government in 1946, gathered pace during the year. No plan intended to be executed over a fairly long period could be strictly adhered to in every detail as the years went by; and the industry's reconstruction schemes had inevitably been subject to review in the light of changing economic and technical conditions.

Of the major schemes contained in the development plan as drafted in 1945, some 65 per cent (in terms of monetary cost) had received the detailed approval of the Iron and Steel Board or, since the latter's dissolution on March 31, 1949, the Iron and Steel Division of the Ministry of Supply. Of the schemes thus approved, about 25 per cent were completed and were already contributing to production; 72 per cent were in active execution; and in the case of the remaining 3 per cent work had not yet begun on the site.

The good relations between mangements and labour, for which the industry is noted, were again evident in 1949. Wages were high; there was almost complete freedom from dispute and steady progress was made in joint consultation.

Several completed development schemes should contribute to provide the increase

in 1950 to 15.75 million tons; notably the reconstruction of the melting shop at the Round Oak Works, Staffs., where capacity will be raised from 160,000 tons a year to 250,000 tons; the installation of a new blast furnace, ore handling plant and melting plant at the Skinningrove Works, North-East Coast, where ingot capacity will be increased by nearly 100,000 tons a year; and the installation of a new open hearth furnace plant at Stewarts & Lloyds, Corby, where capacity will be raised by 140,000 tons a year.

The greatest increase in capacity represented by any single development scheme is that at Margam, which will raise the total capacity of this works to over one million tons a year in 1951.

Progressive Reduction of Imports

There should be a further reduction in imports in 1950, which should fall from the 1.2 million ingot tons reached in 1949 to about 850,000 ingot tons. An approach will thus be made to the level of 500,000 tons regarded in the development plan and in all subsequent international discussions as the normal import requirements for the early '50's, under conditions of full employment.

The report foresees that, after the increase of 1.2 million tons registered in the past two years, stocks may well come down. The increase in stocks in the hands of producers had been due, in part, to the exceptionally high imports of 1949. Now that imports are falling again, a reduction in stocks of about 600,000 tons might be effected in 1950.

The total amount of steel thus made available for consumption in 1950 should be of the order of 17.7 million ingot tons, an increase of one million tons over the quantity available in 1949. An official estimate has assessed demand round about 1953, assuming full employment, at 18 million tons—14.5 million tons for home use and 3.5 million tons for exports; supplies, therefore, should be falling not far short of this figure even next year.

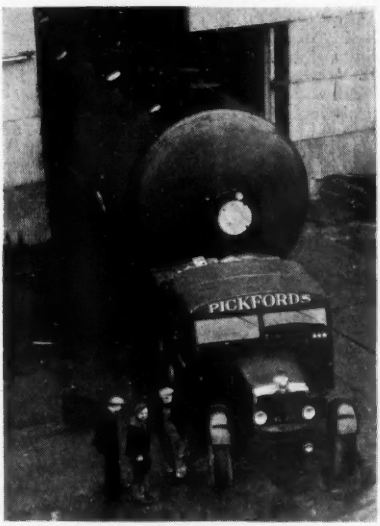
The cuts in capital expenditure announced by the Government after the devaluation of the pound will mean a shrinking in 1950 in the demand for steel for home investment; on the other hand, still more steel will be needed for indirect export by the steel-using industries.

For all home purposes there should be needed about 14.7 million tons, compared with 14.3 million tons in 1949, leaving a margin of 3 million ingot tons available for direct export. The steel most easily exported directly is, in the main, the heavy steel, the demand for which has been affected by the Government's policy in capital investment.

To export steel to the dollar area will, of course, not be easy, though the contracts for $16 million worth of products received from Canada over the next 12 months—a doubling of the present rate of export to that country—are an encouraging sign. There is no reason why this increase should not be made permanent, for British steel shipped to Canadian coastal districts is fully competitive with American steel imported overland.

The BISF emphasises that in the four-and-a-half years which have followed the end of the war the iron and steel industry has played a notable part in the rebuilding of the national economy. That this is so is due to the industry's success in improving its capacity and in presuming the requisite supplies of raw materials, though the cost of these threatens to be one of the major difficulties of 1950.

Leviathan Emerges



[Copyright, Anglo-Iranian Oil Co., Ltd.

The fractionating column built by the Motherwell Bridge and Engineering Co. for Scottish Oils, Ltd., setting out on its 60-mile journey from Motherwell to Grangemouth. A special route had to be mapped for this massive piece of engineering 98 ft. long, 13 ft. in diameter and weighing 66½ tons

DEVELOPMENT OF POWDER METALLURGY

*Important Contribution of the Metallwerk Plansee**

THE development of the important metallurgical factory at Reutte, in the Austrian Tyrol, of the Metallwerk Plansee, is closely bound up with the rise of powder metallurgy, and it may well be said that the technique of sintering has been contributed to in no small measure by the research work of this establishment.

There are numerous reasons for the growing importance of powder metallurgy, among which are:—

(1) Some metals like tungsten, molybdenum, tantalum and niobium have such high melting points that they cannot be produced by melting, on account of the lack of the suitable crucible materials. The sintering process offers a way of producing these materials in a ductile form.

(2) In the powder metallurgical process the material does not come into contact with any contaminating crucible material or slags, and therefore the purest metals can be obtained, for instance purest iron, nickel, and various alloys for the high-vacuum technique.

(3) All sintered metals are more or less porous and can be used as materials permeable to gas and fluids, for which a certain porosity is desired, as for oil-charged bearings, filters, diaphragms, etc.

Producing Diamond Materials

(4) Certain metals cannot be alloyed in a liquid state by melting on account of their different melting points and immiscibility. The most important contact materials, tungsten-copper, tungsten-silver, silver-nickel, etc., can be produced only by means of sintering. One can thus produce metal-carbon and diamond materials, the components of which are otherwise immiscible.

(5) The production of hard metals, based upon WC-Co and WC-TIC-Co, is only possible by the sintering process, *e.g.*, tungsten carbide (WC), as otherwise they decompose by melting into W_2C, WC and graphite.

(6) Economical reasons are also often deciding factors for using the sintering process. The production of sintered iron and sintered steel moulds and of sintered magnets are examples where powder metallurgy competes with other methods.

* Abridged translation from a report by Dr. R. Kieffer and Eng. F. Benesovsky, the *Journal of the Technical Museum*, Vienna.

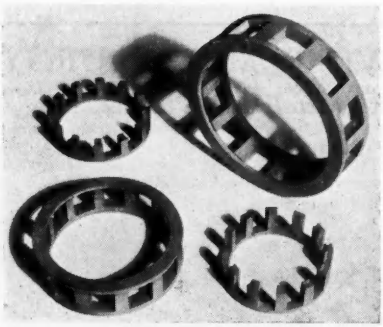
General view of the Metallwerk Plansee

The Metallwerk Plansee produces, with few exceptions, all these groups of powder-metal materials. The steadily increasing demand for tungsten, and more especially molybdenum, for incandescent lamps, Röntgen tubes, and for the radio industry, which developed such impetus after the first world war, induced Dr. Paul Schwarzkopf, an Austrian, to establish in 1921 these metal works. Before that, he had already had experience in the field of high-melting metals as founder and partner of the Deutsche Glühfadenfabrik Richard Kurtz and Dr. Paul Schwartzkopf, Berlin.

The district between the Austrian Tyrol and Bavaria has the advantage of plentiful and cheaply produced electric energy, so necessary for the production of the high-melting-point metals, from the nearby hydro-electric plant of the borough of Reutte. From a small beginning, when the works employed only 50 persons, it has now grown into an establishment which is among the best known of the powder metallurgical plants of the world.

The initial products were mainly molybdenum wire and sheet for the incandescent lamp and radio valve industry, also tungsten parts for Röntgen tubes. The sintering process now applied to molybdenum was developed on the basis of the original experiments by W. H. Wollaston, the research of Auer von Welsbach, F. Skaupy and others, and was brought in 1908 to technical efficiency by the American C. Coolidge.

Prior to the 1914-18 war, tungsten and molybdenum wires were already produced



Sintered roller-beds

in all important countries for incandescent lamps. The demand increased after the war in line with the development of the electronic valve technique and the radio industry, to such a degree that the newly formed Plansee establishment set up a subsidiary plant in Sill, south of Innsbrück, which was intended for the production of molybdenum, tungsten and other high-melting-point metals and alloys.

The production of materials and metals for high-vacuum purposes demands the purest raw materials. The production of refined molybdenum and tungsten trioxide, the starting product, was found to be comparatively difficult by chemical means, but the process of P. Schwarzkopf and A. Schmitt for the sublimation of molybdenum acid, produced in a simple way the purest molybdenum trioxide from impure raw materials (roasted molybdenum ore and residues, etc.).

As molybdenum acid evaporates at 700°C. it is impossible to obtain at this temperature a separation from impurities not yet volatile. Repeated experiments to produce purest tungsten trioxide by sublimation failed, as the accompanying oxides gave at the distillation temperature of WO_3 (about 1400°C.) a too high steam pressure.

Tungsten and molybdenum were soon used, in addition to the lamp and valve industry, as heating elements in high-temperature furnaces in the form of wires and ribbons. This was mainly due to the work of P. Werner and F. Krall, of Reutte. Most of the high-temperature sintering, muffle and hammer furnaces now in use are fitted with molybdenum heating elements.

Its connection with the high-vacuum technique and related industries induced the Plansee company (in 1930-35) to produce further materials by sintering. The research work by I.G. Farben scientists, particularly L. Schlecht, W. Schubardt and F. Duftschmidt, resulted in 1931 in obtaining very fine and pure carbonyl-iron powder by decomposition of iron carbonyl. This powder, for which at first no demand was noticeable, is most suited for the production of pure alloys by the sintering process.

This was produced by the Plansee works under the trade name of Ommet-iron to serve as electro-deposited material in high-vacuum tubes. Some other alloys which can be sintered by use of carbonyl iron and carbonyl nickel powder are on the market as Sivar melting alloys with iron-nickel-cobalt base, and as Hastelloy alloys with nickel-molybdenum and iron-nickel-molybdenum base. The latter are mainly used in the form of wire for lattices in electronic tubes and as heat-conducting materials.

Carbonyl iron powder soon attained technical importance for the production of soft and permanent magnetic material. The use of lemellar tungsten instead of platinum as a contact material in ignition units for internal combustion motors suggested that tungsten as well as molybdenum could also be used for other similar purposes on account of its high melting point, extreme hardness, the low-welding properties and small loss in burning. A hindrance, however, lies in the rather low electrical conductivity.

By alloying tungsten or molybdenum with good conducting metals, such as copper or silver—which had already been suggested in 1916 in a patent not commercially utilised—one gets compounds which are very suitable as contact materials for high or low voltage switches. These compounds, which cannot be alloyed by a melting process, have been produced since 1932 under the trade name Elmet-Rotung (W-Cu) and Elmet-Silvung (W-Ag).

Sintered Hard-Metal Alloys

The technical production of these contact materials is achieved either by sintering the powder mixture or by impregnating the porous tungsten substances with liquid copper or silver. The fact that the development of sintered hard-metal alloys with tungsten-carbide and tungsten-titanium-carbide basis was very progressive, is due to knowledge of powder-metallurgical methods and of the sintering process.

Basing their research upon the work of W. Lohman, G. Fuchs, A. Kopietz and H. Baumhauer, the metallurgists K. Schröter and F. Skaupy succeeded in

1922 in sintering tungsten-carbide powder with cobalt as a cement and so produced the first technically applicable sintered hard metals. The introduction of this new material has had an effect upon the technique of most metal-working processes.

Sintered hard-metals with Wo-Co base are specially suitable for work on short-shaving metals, for instance, iron and brass, but less so for steel working. The position was, however, changed by the pioneer work of P. Schwarzkopf, I. Hirschel and G. Ballhausen, and especially that of R. Kieffer in 1929-31.

By mixing tungsten - carbide or molybdenum - carbide with carbides of titanium, vanadium or tantalum, and sintering them with cobalt as connecting metal, one obtains hard metals with high tenacity and low welding inclination, which has proved most suitable for steel working even at the highest cutting speeds. These hard metals are patented and marketed under the names of Titanit U1, U2, and U3, and later S1, S2, S3.

Titanit

Together with the DEW-Krefeld, Titanit was utilised in 1931 in the building of the mountain laboratory of the Metallwerk Plansee, where the late Eng. S. Heiss directed the hard metal division. Eventually they took on the production of diamond-metals and hard-metal bound tools according to the processes covered by the patents of R. Kieffer and S. Heiss.

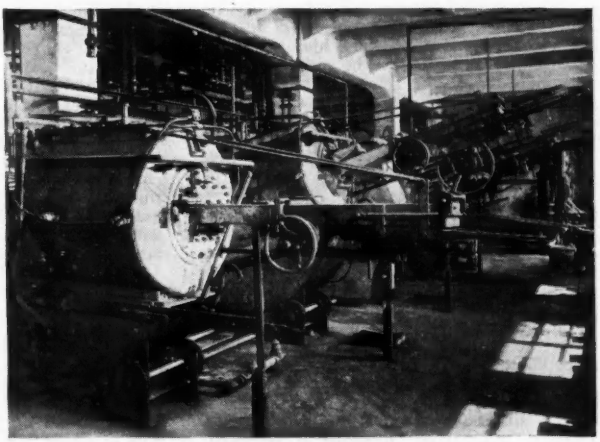
The research work at the Plansee factory, which has contributed so much to the growth and technical importance of powder metallurgy, occurred largely at a time of general economic and political crisis in Austria with consequent export difficulties and scarcity of raw materials. With the over-running of Austria in 1938, the Plansee works were taken over by the DEW-A.G.-Krefeld, and were at the beginning of the second world war incorporated in the general military organisation, remaining exclusively engaged in the sintering of metals. The molybdenum and tungsten production, as well as that of hard-metals and alloys, was increased, and the number of employed persons rose to more than 1000.

Iron-Powder Work

The war period also brought a rapid development of iron-powder metallurgy work. The sintering process thus applied soon competed with other mass-finishing processes, such as temper casting, pressure die casting, precision casting, drop forging, sheet stamping, shaving, etc., and quickly gained a strong position among the different methods of steel shaping. A plant for the production of shell-guiding rings from sintered iron had a monthly capacity of about 120 tons. These items were made from this material on account of its porosity and plasticity.

In the second half of the war, the development of sintered steel was begun and the production of pressed and sintered engine and apparatus parts from iron-graphite powder, whereby the properties of an ordinary carbon steel of some 0.6 per cent content were simulated.

The development of sintered permanent



Tip-up high-temperature sintering furnaces in the Plansee Works, typical of the modern plant being employed in the treatment of a wide range of hard metals and alloys

magnets, which was begun in 1935, led during the war to a production of about 12 tons per month by the Kieffer-Hotop process. The Fe-Al-Ni alloy by Nishima, by which parts can be produced by mould or precision casting, can also be substituted or synthesised by single powder components or from specially prepared alloy powders by pressing and sintering. This method permits the production of finished parts which only need a little subsequent work and which, compared with parts from molten alloys, have a finer granular structure.

Two months after the war, the works started again under the management of Dr. R. Kieffer and F. Herold. At first a heat-conducting alloy with Fe-Al basis was produced by sintering, also ceramic parts for electro-technical uses, as well as heating plates and room radiators. A change to peace-time work provided the motor engine and fitting industry with parts from sintered iron and steel. The experience gained during the war was put to favourable use in the post-war production.

Pressed Magnets

The branch works at Sill, which produced exclusively during the war molybdenum and tungsten, extended its production programme with tungsten powder, molten tungsten carbide for welding purposes, and special drawing stones, also titan carbide and carbide mixed crystals for use in the hard-metal industry. The production of sintered magnets was in 1948 moved from Reutte to Sill, where the making of pressed magnets was carried out by the method of Ugine, Grenoble.

The negotiations for the return of the works to Dr. Schwarzkopf ended in 1948 with their restitution. The history of the Plansee works would not be complete without mention of the related foreign enterprises and their importance to the international economy. The N.V. Molybdenum Company, in Amsterdam, a patent licensee and trading company, and the Vereenigden Draadfabrieken, Nijmegen, are working in collaboration with Plansee.

The U.S.A. introduced in 1930 protective tariffs in connection with the import of high-melting-point metals. To safeguard the American market, the American Electro Metal Corporation was established in Lewiston for the production of molybdenum fine wires from semi-manufactured materials of the Plansee works. This U.S. company moved its activities during the war to Yonkers, where it commenced the production of sintered iron, sintered steel, sintered magnets and high heat-resisting materials. Recently a combine with the Cérametal interests, the Société pour la Métallurgie des Poudres A.R.L., in Walferdingen, Luxemburg, was established, which was granted a licence for the production of the hard-metal Titanit according to the Plansee method. For the extension and maintenance of the market in sintered products many licences have been given to other European States.

A company engaged in such a young industry could, of course, only succeed by maintaining constant research, and the realisation of this led in 1940 to the establishment of a central research station. A result of the combined development and research activities was the publication of the book "Pulvermetallurgie und Sinterwerkstoffe," by R. Kieffer and W. Hotop, 1943. Experiences in the field of sintered iron and steel during the second world war were also covered by R. Kieffer, W. Totop, H. J. Bartels and F. Benesofsky in their book (1948) "Sintereisen und Sinterstahl." These two standard works on powder metallurgy and a great number of publications in technical journals contributed much to the reputation of Austrian science and technique. Dr. Schwarzkopf and his collaborators published (1947) in New York the book "Powder Metallurgy," which met with an enthusiastic reception in America.

Light and Measurement

DETERMINATION of length by means of light was one of the many themes demonstrating recent work of the National Physical Laboratory shown at Burlington House this week. If the source of light is a pure isotope of even atomic mass it has been proved by recent research that more nearly ideal monochromatic radiations are emitted than from naturally occurring elements.

One such isotope has been produced by transforming gold into the mercury isotope of mass 198 by exposing it to neutron irradiation in the atomic pile. The characteristics of green light emitted from this isotope are being investigated internationally to ascertain whether its wavelength is suitable for adoption as the ultimate standard of length. Cadmium red light is already employed to determine the standard yard and metre.

The display was part of the celebrations being held to mark the 50th anniversary of the National Physical Laboratory, or more accurately the appointment of its first director, Sir Richard Glazebrook, in January, 1900, which is generally regarded as the date of the foundation of the laboratory.

TECHNOLOGY OF ALUMINIUM AND ALLOYS

Some Applications and Basic Properties

A CLEAR picture of the potentialities and increasing applications of aluminium and aluminium alloy extruded sections and some valuable basic information about the metal are given in the latest information bulletin (No. 16), of the Aluminium Development Association, London.

In applying aluminium alloys the most evident virtues are the range of strengths available and the remarkably high values obtainable by some of the alloys. Tables 1 and 2 in the bulletin give an indication of the mechanical properties.

For many purposes for which high strength is not necessary the softer alloys, which may be manipulated with ease yet have adequate strength and rigidity, are gaining acceptance. Most aluminium alloys are easily machined and cut, and many of them easily welded.

Resistant Properties

The corrosion resistance of aluminium is impressive. Aluminium spontaneously forms on its surface a passive oxide film which rapidly re-forms on newly cut surfaces. This film is integral with the alloy and offers considerable resistance to weathering; it is continuous, tough and transparent.

It may be reinforced both by chemical and electrochemical processes. The thicker and more protective films so formed give an excellent base for paint.

All aluminium alloys possess high resistance to the kind of atmospheric attack which occurs in industrial service. In many applications it is not essential to paint aluminium alloys.

Where aluminium alloys are used in stonework it is found, contrary to experience with other metals, that the stone does not become stained.

References to the materials used are those adopted in the new British Standard Specifications for Wrought Aluminium and Aluminium Alloys for General Engineering Purposes.

Grades of pure aluminium and composition of alloys are denoted by numbers. Prefix N indicates non-heat-treatable alloy and H heat-treatable alloy; a second letter denotes the form of the material—E for extrusion, S for sheet, T for tubes. A suffix letter indicates the condition of the material: M = "as extruded"; T = solution heat-treated and naturally aged; W = solution-treated but able to respond to further heat-treatment; WP = solution and precipitation heat-treated. Thus, reference HE10-WP denotes heat-treatable alloy 10 in the form of extruded section and in the fully heat-treated condition.

TABLE 1.—NOT SUITABLE FOR HEAT TREATMENT

B.S./Gen. Eng. Series No.	Nominal Compositions	0.1% Proof Stress (tons/in.²) *	Ultimate Tensile Stress (tons/in.²) *	Elongation (% on 2 in.) *	Brinell Hardness (typical)
E1C–M	A1 99% purity	—	4	20	22
NE4–M	1.75–2.75% Mg	—	11	18	45
NE5–M	3.0 –4.0% Mg	6	14	18	55
NE6–M	4.5 –5.5 % Mg	8	16	18	65
NE7–M	6.5 –7.5 % Mg	9	20	18	75

* Specification minima.

The methods available for assembling a structure are by bolting, riveting, fusion and resistance welding; the use of brazing and of adhesives for certain joining problems has also been developed with considerable success. The strongest alloys should be spot welded, riveted or bolted together.

Aluminium alloy rivets are available in a number of alloys and in a wide range of sizes and shapes: these rivets should be cold-snapped and considerable mechanical force is required, especially in the larger sizes. It is also customary to use mild steel rivets in certain large constructions, driving them hot, as in steel practice.

Four aluminium alloys are recommended as rivet materials for general engineering purposes, namely NR6-M, HR10-W and -WP, HR13-T and HR14-T. (Tables 1 and 2 give the nominal composition of these alloys.) The ultimate shear strength of mild steel is about 15 tons/in.², that of NR6-M about 11 tons/in.², HR10-W 11 tons/in.², HR10-WP 13 tons/in.², HR13-T 13 tons/in.² and HR14-T 17 tons/in.². If HR14, the strongest of these, is used, the rivets must be driven within two hours of quenching from 500°C.

The spontaneous age-hardening which follows quenching can be retarded, however, by storing the rivets (preferably immersed in methylated spirit and water) in a refrigerated box; the two-hour period then begins on removing the rivets from cold storage. For HR14 material, safe storage periods range from 2 hours at room temperature to 150 hours at −20°C. Alloys NR6, HR10 and HR13 may be driven in the "as received" condition, but the shear strength of these materials is lower.

Mild steel rivets are driven hot, and this operation may be carried out without detriment to the properties of the aluminium alloy being riveted, provided the sequence or speed of driving is such that undue heating of any particular part of the structure being riveted does not occur.

Welding Methods

With sections made in the non-heat-treated alloys, joining may be effected by resistance, arc and gas welding methods when the necessary skill has been acquired. Under the best conditions, weld efficiencies up to about 90 per cent of the parent metal strength are obtainable.

The heat-treatable alloys suffer a more marked reduction in strength at the weld owing to the removal, by welding heat, of the characteristic wrought structure and of the heat-treatment effects.

The application of brazing to aluminium alloys has been developed considerably in the last few years and specific recommendations are available for single jobs and for batch operation. Essential requirements are careful pre-cleaning, thorough removal of flux after jointing, and careful jigging.

Synthetic resin adhesives are particularly suitable for aluminium alloys, and an example of their application is in the assembly of textile spinning bobbins. Die-cast flanges and extruded tubes are machined, to an interference fit if required, bearing surfaces are given a thin coating of adhesive, and the two components are then fitted together under pressure. Some bonding processes require both heat and pressure; others, heat only.

The approximate point at which, under tensile stress, permanent deformation of aluminium and other non-ferrous metals begins is known as the "proof stress." The proof stress of a particular alloy is therefore the point on its stress/strain curve which corresponds closely to the yield point on the curve for mild steel, and is used because aluminium alloys show no definite yield point.

In general design practice, reference is made to the 0.1 per cent proof stress, which by definition is "the maximum load per sq. in. that, when applied to a tensile test

TABLE 2.—HEAT-TREATABLE MATERIALS

B.S./Gen. Eng. Series No. or Equivalent Reference	Nominal Compositions	0.1% Proof Stress (tons/in.²) *	Ultimate Tensile Stress (tons/in.²) *	Elongation % on 2 in. *	Brinell Hardness (typical)	Temperature Range for Solution Heat-treatment (°C.)	Conditions for Precipitation Heat-treatment applicable	
							Temperature Range (°C.)	Period (hours)
HE9–W HE9–WP	0.4–0.9% Mg 0.3–0.7% Si	5 10	9 12	18 12	48 75	525–540 525–540	160	12–14
HE10–W HE10–WP	0.4–1.5% Mg, 0.75–1.3% Si	7 15	12 18	18 10	65 95	525–540 525–540	160–185	5–15
HE11–W HE11–WP	1.0–2.0% Cu, 0.5–1.25% Mg, 0.75–1.25% Si	10 20	17 25	15 8	90 120	520–530 520–530	170	8–12
HE14–T	3.5–5.0% Cu, 0.4%–1.2% Mg, 0.7% Si, 0.4–1.2% Mn, etc.	15	25	15	120	485–505		
HE15–W HE15–WP	3.5–4.8% Cu, 0.6% Mg, 1.5% Si, 1.2% Mn, etc.	15 26	25 30	15 8	115 145	505–515 505–515	155–185	5–20
BS4L25	3.5–4.5% Cu, 1.2–1.7% Mg, 1.8–2.3% Ni	14	24	15	120	490–525		
DTD363A	4.0–8.5% Zn, 4.0% Mg, 3.0% Cu, 1.0% Mn, etc.	33	38	5	155	455–465	130–140	4–8

*Specification minima.

piece for 15 seconds and removed, produces a permanent extension of not more than 0.1 per cent of the gauge length."

For heat-treatable aluminium alloys, proof stress is much nearer to ultimate tensile stress than for the non-heat-treatable materials. The properties can be compared by examining columns 3 and 4 of Tables 1 and 2, and the difference between proof and ultimate tensile stress is of special significance to designers when assessing factors of safety.

The mechanical constants of the aluminium alloys (Table 3) show the elastic modulus of aluminium to be a little more than one-third that of steel. From this a correspondingly greater deflection under load is to be expected, unless the aluminium member is increased in sectional size or some other disposition is made in section design.

For equal tensile strengths, a length of aluminium alloy HE15 would have about the same cross-sectional area as a length of mild steel, but would be less than half the weight; but for members under load, deflecting equally, an aluminium beam of, say, 7 by 4 in. would correspond to a steel beam of 5 by 3 in.

Of these two, however, the tensile strength of the beam in HE15 would be so much greater that—unless extra margin were wanted for another reason—a material of lower tensile strength, such as NE6, might be used.

Lightness with Strength

The weight saved by using aluminium alloy would in either case be about 40 per cent. An aluminium alloy structure is thus about one-half the weight of a steel structure of equal strength and rigidity.

An advantage of the lower modulus appears when aluminium structures are subjected to shock conditions of loading; then their greater resilience permits the absorption of more energy than is possible with a comparable steel structure.

In the design of short struts under compression, the value of proof stress in tension is used, but for less compact members suitable column or buckling formulæ are applied. Maximum stress in compression cannot be determined for ductile materials such as aluminium alloys.

The ultimate shear stress for an aluminium alloy is about 60 per cent of the ultimate tensile strength, and bearing strength is about equal to the tensile figure. Under fatigue test aluminium alloys, in common with most non-ferrous metals, do not show such a definite fatigue limit as mild steel; although the aluminium-magnesium alloys are a possible exception to this generalisation.

Common practice is to apply a figure of 30 per cent of minimum ultimate tensile stress to structures for which fatigue is not a factor of major importance. In other circumstances, if published information is not available, the supplier of the material should be consulted for data on which to base calculations.

Notwithstanding the difficulties extremely complicated shapes are produced by the extrusion process.

From the user's point of view, extrusions offer a number of features that are not available in rolled shapes. It is possible to obtain sections which have re-entrant angles; to have considerable variations of thickness in different parts of the cross-section of extrusions, and to obtain hollow sections. No taper or draw is normally necessary, as in the case of rolled sections.

TABLE 3.—CONSTANTS APPLICABLE TO ALUMINIUM AND THE ALLOYS

Modulus of elasticity (E)	10–10.5 × 10⁶ lb./in.²
Torsion modulus (G)	3.8 × 10⁶ lb./in.²
Poisson's ratio	0.33
Specific gravity	Between 2.6 and 2.9
Coefficient of linear expansion per °C (20–100°C.)	22–24 × 10⁻⁶
Thermal conductivity (0–100°C.) (C.G.S. units)	0.32–0.53
Specific resistance at 20° C. (microhms per cm. cube)	Aluminium alloys 2.9–5.9 Pure aluminium 2.845 (B.S.215)
Specific heat at 20° C. (cal. per gram per ° C.)	Aluminium alloys 0.22–0.25. Pure aluminium 0.214
Melting points	Aluminium alloys 510–650° C. Pure aluminium 660° C.

NEW USES FOR PTFE

Protection of Chemical Equipment

THE constantly widening field of industrial applications of CF_2—the thermoplastic material prepared by the controlled processing of polytetrafluoroethylene (THE CHEMICAL AGE, *60*, 10)—was the subject of a demonstration at a reception in London last week by the makers, Crane Packing, Ltd.

The products to which attention particularly was directed were gland packings, pipe jointings and valve seatings, developed for use with chemicals and acids of a highly solvent or corrosive nature (THE CHEMICAL AGE, *61*, 699).

It was also shown that CF_2, moulded into gaskets of any required size, is an effective means of providing protection at the joints of pipes or tubes in acid pumps, etc.

Gland packings of this material are stated to be unaffected, within the temperature range—60° F. to 450° F., by contact with inorganic acids, oleum, plating solutions, caustic alkali solutions, HCl gas, SO_3, SO_2, oxides of nitrogen, all halogen gases except fluorine, and oxygen.

For less severe conditions there are other packings, such as those constructed by spirally wrapping or braiding CF_2 tape around a core of suitable material, or those composed entirely of tape in braided form.

In tape form the thermoplastic is an efficient insulator at high ambient temperatures. It is thermally stable and possesses good electrical properties.

The density of CF_2 in moulded form is 2.2 and its tensile strength 2000 p.s.i. (The super-tensilated form has a strength of up to 15,000 p.s.i.). Elongation is from 50-400 per cent. The power factor is claimed to be 0.0002 and the dielectric constant 2.1 over a wide range of frequencies.

The main disadvantages of CF_2 are its comparatively high cost at present and the fact that, when subjected to very high temperatures, it disintegrates and gives off toxic fumes.

Swiss Chemical Exports

Swiss exports of chemical and pharmaceutical products (in million Swiss francs) amounted to 504.4 in 1949, compared with 547.6 in 1948 and 166.5 in 1938. Although aniline dyes and indigo receded from the 1948 peak of 260.1 to 212.2 (83.0 in 1938) they still occupy the first place among the four main groups of chemical exports. Shipments of industrial chemicals declined from 81.7 to 70.5 (22.8 in 1938).

CANADA'S CHEMICALS

Full Supply for Home Uses

FOR the first time in almost a decade, production of industrial chemicals in Canada in 1949 was generally sufficient to meet demand, according to George W. Huggett, chairman and president of Canadian Industries, Ltd., in a survey of the chemical and allied industries. As a result of the improvement in the supply of some chemicals, there had been a shift in emphasis from production to the development of markets in order that capacity operations could be maintained.

Imports had increased in proportion to the higher level of chemical production.

The CIL chairman states that the rate of increase in costs showed signs of moderating and the selling prices of some chemical products dropped, but most of these trends had been reversed by the devaluation in September of the Canadian dolla

The chief contributory factor in the better supply position was the additional plant capacity provided by postwar expansion. Henceforth, a larger portion of capital expenditure would be devoted to the erection of plants for the manufacture of new products or of chemicals formerly obtained from abroad.

Fischer-Tropsch Principles in U.S.A.

HAVING completed arrangements with Ruhrchemie and Lurgi for licenses and access to all process information developed by these German firms, the Blaw-Knox Company, Pittsburgh, Pennsylvania, has formed a chemicals and fuels synthesis department which will deal principally with the conversion of fuels into chemicals based initially on the Fischer-Tropsch and related processes. Ruhrchemie pioneered the development of the Fischer-Tropsch production of gasoline from synthesis gas derived from coal, while Lurgi built plants of this type and contributed to coal gasification.

The Fischer-Tropsch process can use any one of a number of raw materials as a source for the intermediate feed material, synthesis gas. Blaw-Knox visualises opportunity in the construction of highly integrated units for the synthesis of valuable chemicals and oils from natural gas and possibly other economical fuel sources.

Technical Publications

INCREASING importance has been attached in recent years to the chemist's part in the progress of processing food and the production of its raw materials. The Society of Chemical Industry has now attained a long-cherished ambition in the publication of a monthly periodical of the *Journal of the Science of Food and Agriculture* (January, 1950) now available. Lord Bruce contributes an article on "The World Food Situation and the Work of the FAO." Other features include: "The Enzymatic Degradation of Ascorbic Acid—Part I," by F. C. Hooper and A. D. Ayres, and "A Method for Improving the Keeping Quality of Bread," by R. S. Alcock and J. King. There are messages of welcome from the Ministers of Food and Agriculture and from the president of the society.

* * *

"CHEMISTRY," according to Duclaux, "is the basis of everything, and nothing escapes it." The need for international co-operation in the all-embracing science was recognised by the formation of the International Union of Pure and Applied Chemistry, the origins of which are recalled in the January issue of *Endeavour* (Vol. 9, No. 33) by Prof. R. Delaby, who also describes its present structure and shows its active participation in scientific progress. Other features include: "Cyclo-polyolefins and Related Molecules," by Prof. Wilson Baker, and "Plant Cancer" by R. J. Gautheret.

* * *

THE application of physics in industry has been one of the particular concerns of the Institute of Physics since its foundation in 1918. It has now been found possible to start a monthly publication devoted specifically to this subject, the first number of which, *The British Journal of Applied Physics* (January), has just been issued. Included are special articles by Sir Philip Morris on "A Scientific Education," and "Some Chemical and Physical Properties of Rubber" by J. Moore, and a number of original papers and reviews of new books.

* * *

"DO'S and Dont's" for the process of vitreous enamelling are set out in a booklet just issued by the Vitreous Enamellers' Association with the co-operation of the Council of Industrial Design. While many of the precautions appear somewhat elementary their recommendation by the Vitreous Enamellers' Association indicates that their observance is not as widespread as might have been assumed.

* * *

THE present (22nd) edition of "Chemical Industries" (Dr. E. N. Tiratsoo; Leonard Hill, Ltd.), has been completely revised. There are some 4500 references and cross-references in the index to technical data, and the data of organic and inorganic compounds lists some 2000 chemicals. The classified index has been divided into two sub-sections—chemicals and plant. A new feature is a section devoted to refrigeration supplementing those dealing with fuels, power production and transmission, and water treatment, added in 1948.

* * *

FROM the chemical point of view, the action upon a metal surface either of milk and milk acids, alkaline detergents or the strong hypochlorites used for sterilising is a factor of much importance. Experience has shown that no such chemical action occurs on stainless steel pipes. Their uses

(*continued at foot of next page*)

COLD-WELDED ALUMINIUM

These flanged containers are formed from aluminium slugs by impact extrusion. The welding faces of the flange and the disc lid are welded in one quick operation by cold pressure welding

[Photograph, General Electric Co.

D

Targets for Fuel and Power Research

Work of the Chief Scientist's Division

THE responsibility of the Ministry of Fuel and Power in encouraging and co-ordinating the development of research throughout the whole of the fuel and power field was explained at a Press conference in London last week.

The main objective of his division, to achieve the most economical integration of fuel and power services, was explained by the chief scientist, Dr. H. Roxbee Cox, who also described some of the main items at present being investigated.

Some difficulties, he said, had been experienced in the horizontal boring for the underground gasification of coal at a site near Chesterfield (THE CHEMICAL AGE, *61*, 761) but progress was satisfactory and it was expected to " light up " early this year.

The heat pump, although not a new idea, had received little attention in this country, and the Ministry had considered it worthy of fuller investigation. Calculations had shown that there would be economic advantages in driving the heat pump by gas engines.

Tests were being made with Merlin aero-engines converted to running on town gas. The superchargers had been modified to provide the compression required in the heat pump circuit. It was proposed, with the collaboration of the LCC, to employ such a pump to provide part of the heating for the new concert hall being built on the south bank of the Thames.

Coal consuming, peat gas and firedamp turbines were all being investigated and showed considerable promise in their own spheres.

Survey of fuel consumption in twelve major industries is at present being undertaken. By study of plants and processes it is hoped to enable manufacturers to reduce costs by more efficient fuel utilisation. The industries receiving attention are beet sugar, cement, glass, horticulture, lime-burning, non-ferrous metals, paper, rubber, sanitary earthenware, silk, soap, and wool.

The mobile testing unit for savings in fuel consumption introduced last year (THE CHEMICAL AGE, *59*, 781; *62*, 5 and 129) had been highly successful, and it had been decided to introduce three further units immediately, following the number of requests received for its use.

In view of the benefit received from " bringing the laboratory to the factory," and so that the whole cost should not fall on the public purse, it had been decided that from this month, firms requiring the unit would be asked to make a contribution of £15 each day of use to cover maintenance and running cost.

TECHNICAL PUBLICATIONS

(*continued from previous page*)

in the dairy industry for food processing and fermentation are described in a brochure just published by the export organisation of Tube Investments, Ltd., London. This is one of a series of technical booklets dealing with the application of high-grade steel tube and metals sections in a particular trade being produced by the T.I. (Export), Ltd.

* * *

A bibliography with abstracts of published reports on Vitamin B_{12} divided into two parts, laboratory and clinical, is now available from Glaxo Laboratories, Ltd., Greenford, Middlesex.

* * *

WEAR, from the scientist's standpoint, is the subject of the article in Operating Notes in " Deco Trefoil " (Vol. 13, No. 6) published by the Denver Equipment Co. The main feature is an article on industrial and chemical applications of froth flotation by Lawrence A. Roe, technical supervisor, division of ore reasearch, Jones and Laughlin Steel Corporation, Negaunee, Michigan.

* * *

THE non-flammable properties of nylon which melts but does not burn, and the urgent need for evolving a non-flammable treatment of cotton fabrics which would be fast to washing, not spoil the " feel " of the material and not be too expensive are discussed by Dr. Leonard Colebrook in an article " Prevention of Burns in the Home " in the January, 1950, issue of the *FPA Journal*, published by the FOC Fire Protection Association.

* * *

A SURVEY of recent and revised British Standards, amendments, future publications and new work started is contained in the December issue of the British Standards Institution monthly information sheet. There is a list of new overseas standards available in the BSI library.

HOME

Safety Glass

Sir Graham Cunningham, chairman of Triplex Safety Glass Co., Ltd., has stated that his company's exports of laminated safety glass in 1949 were more than 31 times greater than in 1938.

Cellulose Film Prices

The voluntary price control exercised over U.K. manufacturers' prices of cellulose film on the home market has been removed as from January 23. The current prices are only about 11 per cent above those ruling before the war.

Research and Production

The British Welding Research Association will hold an exhibition devoted to "Research and Production" from February 7-11. The exhibition will be open daily from 10 a.m. to 5.30 p.m. at the association's London headquarters, 29 Park Crescent, W.1.

Smokeless Zone Scheme Postponed

Salford's plan to establish three smokeless zones in the city by April and to become one of the first "smokeless cities" in the country, has had to be postponed until after September. The cost of equipment and the problem of providing smokeless fuel are responsible for the postponement.

Gas Explosion

When a gas cylinder exploded at the works of British Cutting Gases, Ltd., Chester Road, Hulme, Manchester, three men were badly burned about the face and hands, and six others—cut off by a wall of flame—escaped over a 15-ft. wall. It is believed that the explosion took place while a cylinder was being filled with propane gas. The firm states that full production was resumed shortly after the accident.

Colloidal Dispersions of Silica

Monsanto Chemicals, Ltd., announces that it has purchased from the National Aluminate Corporation of America its patent rights in the U.K. pertaining to the manufacture of the colloidal dispersions of silica which are sold in the U.S.A. under the trade name Nalcoag. Monsanto has been manufacturing colloidal dispersions of silica in the U.K. for the past two years under the registered trade mark Syton. In acquiring these rights the company will seek to incorporate the results of its own and American experience in the further development of the Syton products.

Coal Production

Britain's deep-mined coal output again fell last week. Production amounted to 4,125,100 tons against 4,174,200 tons in the previous week and 4,231,400 tons in the week ended January 14. Deep-mined output in the same period last year was 4,090,300 tons.

Chemical Company for Sale

Applications for tenders for the purchase of Products Quimicos Gehe, Barcelona, are invited in a recent announcement in the Spanish *Boletin Oficial*. Any United Kingdom inquiries should go to the German Property Section of the Ministry of Foreign Affairs, Ministerio de Asuntos Exteriores, Secion de Bloques, Plaza Provincial 1, Madrid.

Cheaper Streptomycin

Within three months of streptomycin becoming available on prescription, Glaxo Laboratories, Ltd., have announced a price reduction of 1s. to 6s. per vial. This has been made possible by economies in production processes. Glaxo's two northern factories are now producing sufficient streptomycin to supply all requests they receive and leave an export surplus.

Science and Technology

The emphasis laid on academic science as opposed to technological study at the universities was deplored by E. A. C. Chamberlain in a letter to the Press recently. The main need of Scottish industry at present, the writer maintains, is of men who can bring scientific method and discovery to the daily practice of industry. He considered the present system led to reluctance among students to take industrial posts.

New Rayon Association

The newly formed Flat Dyed Rayon Association, Midland Bank Buildings, Spring Gardens, Manchester, has taken over from the Flat Dyed Rayon Group all functions, including technical problems, price, trade conditions, policy and trade contacts. The latter group has stabilised the conditions under which the Flat Dyed Rayon industry is conducted and the new association will concentrate largely on promoting technical efficiency within the industry and stimulating competition under equitable conditions of trading. Mr. William Crossley, chairman of the group, is chairman of the new association and Mr. D. Marshall, manager.

· PERSONAL ·

DR. J. PEARSON has been appointed head of the chemistry department of the British Iron and Steel Research Association in succession to DR. F. D. RICHARDSON (THE CHEMICAL AGE, 62, 138). He has been head of the chemistry section of the BISRA laboratories at Sketty Hall, Swansea, since 1946, where he has worked on the disposal of spent pickle liquor, gas pickling of steel, preparation of replicas for surface finish assessment, etc. Dr. Pearson is a graduate of London University and has previously worked with Tube Investments, Ltd., also with the Armament Research Department of the Ministry of Supply, at Woolwich. He received the degree of Ph.D. in 1946 for research on the polarography of nitro-compounds. In his new post he will be responsible for research on physical chemistry of iron and steel making, refractories and problems of corrosion.

Reed Brothers (Engineering), Ltd., London, announces the appointment of MR. T. F. MCHARDY as manager of its chemical plant section, in place of MR. P. RICHFIELD. In view of Mr. McHardy's experience in the design of chemical plant the firm hopes to be able to extend its facilities offered to customers to manufacture specialised equipment as well as handling modern second-hand plant.

The Liverpool University Chemical Society Medal for 1950 has been awarded to DR. W. H. GARRETT, a director of Monsanto Chemicals, Ltd. It will be presented at the society's meeting on February 23, when Dr. Garrett will deliver the Medal lecture on "The Need for Flexibility in University and Industrial Relations."

THE EARL OF DERBY, M.C., has accepted the presidency of the John Benn Boys' Hostels Association in succession to the late Viscount Leverhulme, and will preside at its annual dinner to be held at the Connaught Rooms on May 17. The Association maintains King George's House, Stockwell, a residential club for homeless boys, of whom more than 1000 have been aided by the association since it was inaugurated in 1927.

The award of the Melchett Medal for 1950 has been made to DR. REGINALD JOSIAH SARJANT, professor of fuel technology at the University of Sheffield.

SIR HENRY DALE left by sea last week for a three months' lecture tour of New Zealand and Canada on behalf of the British Council. He is to lecture mainly to medical and scientific audiences but a number of public lectures have also been arranged. In New Zealand, where he is due to arrive on February 26, he and Lady Dale will be the guests of the New Zealand Government. After touring the principal towns and universities there he expects to fly to Vancouver on April 25. His lecture subjects will include: "Chemical Transmission of the Effects of Nerve Impulses"; "Histamine and the Anti-Histamines"; "The Proper Place of Science in Education"; and "Chemotherapy, its Origin and Current Developments."

The council of the Institute of Fuel announces that MR. JAMES FRANCIS RONCA will succeed DR. D. T. A. TOWNEND as president in October, 1950. Mr. Ronca has served since May, 1945, as the honorary secretary of the institute and was previously a member of council from 1933.

SIR ALEXANDER FLEMING will visit Leeds next month to receive the Addingham Gold Medal awarded for the most valuable discovery in relieving human suffering. The medal is one of three provided for under the will of Mr. William Hoffman Wood, a Leeds architect, who died in 1933.

SIR ERNEST BENN, who is in Oxted Cottage Hospital with a severe attack of bronchitis, is reported to be making slow but steady progress.

Obituary

MR. H. ELIAS BUC, Russian-born organic chemist, who for 24 years was a research chemist for the Standard Oil Development Company, died in his home at Roselle, New Jersey, on January 21, at the age of 69. Mr. Buc went to the United States at the age of 14 and when he died was the holder of 130 petroleum patents.

Institute of Metallurgists' Examinations

Examinations for the licentiateship and associateship of the Institute of Metallurgists will be held from August 28 to September 4. Applications to enter the examinations must be submitted before June 1.

OVERSEAS

Norwegian Drugs a State Monopoly

In his speech at the recent opening of the new Norwegian Parliament, King Haakon announced that proposals would be put forward for the establishment of a State monopoly for, *inter alia*, pharmaceutical supplies, states the bulletin of the Royal Norwegian Information Service in London.

New Tunisian Fertiliser Plant

A superphosphate factory being constructed in Tunisia by the Cie du Sfax-Gafsa is to treat low quality phosphates to produce a superphosphate. It will absorb 500 tons of phosphates daily and should produce just over 300 tons of superphosphates by the end of 1950. A branch of the railway on the Gabes road outside Oued Maou has been constructed to serve it.

French Bauxite Survey

Recent estimates place French bauxite reserves at 15 million tons of aluminium bauxite and 60 million tons of silicous bauxite. The presence of bauxite has been noted in the Massif Central, and in the Madriat region a thick superficial seam up to 25 metres, has been found. Aluminium content rarely exceeds 40 per cent.

Norwegian Nitrogen Record

Norsk Hydro, one of the world's largest producers of nitrogen products, reports that for the first time in its history (since 1905), production last year was in excess of 100,000 tons of nitrogen. At present Norway is among the 10 largest nitrogen producers in the world, and one of the five largest exporters of nitrogenous fertilisers. The expansion programme, now in progress, aims at bringing the company's nitrogen production to 175,000 tons yearly by 1952.

Alleged Alien Property Dispute

The dispute over the final disposition of the holdings of the General Aniline and Film Corporation seized by the U.S. Government as alien property during the war is expected to come up for trial early next month. A claim by the I.G. Chemie of Basle, Switzerland, that it was the former owner of the General Aniline stock and that the stock was improperly seized during the war, was refused by Judge Pine. The Remington-Rand Co. is also involved as claiming that it had a contract with the Swiss firm to buy the General Aniline stock in 1946.

Swiss Geologists for Persia

The Persian Council of Ministers has recently given its approval to a decree which provides for the employment, by the Persian Government, of a group of seven Swiss geologists. The group is headed by Prof. Heim, who has drawn up an oil exploratory programme for those parts of the country in which the Anglo-Iranian Oil Company does not hold concessions.

Indian Protective Tariffs

The Government of India has accepted the Tariff Board's recommendation that the existing protective duties on non-ferrous metals, which are due to expire on March 31, should remain in force until the end of March 1951. The Government has also accepted a recommendation that the duty of 18.75 per cent *ad valorem* on ferro-silicon should be continued up to March 31, 1951.

Pharmaceutical Packings for Sweden

Reports from Sweden indicate a great demand there for every kind of packing material for pharmaceutical products, especially medicine bottles, ointment jars, glass tubes for tablets, etc., all of which were bought chiefly from Germany before the war. Competition by foreign makers is reported to be considerable, and stipulated standards of quality are higher than ever before.

Costly Sulphate of Ammonia

Queensland sugar cane growers are protesting at the high cost of sulphate of ammonia, increased by £2 per ton in the summer and now again raised by £2, making the selling price to users £22 17s. 6d. per ton f.o.r. Brisbane, despite the Federal Government's announcement that a subsidy of £500,000 would be made available for that commodity. The subsidy represents between £6 and £6 10s. per ton.

Plastics Plant in Latin America

First steps towards developing its own plastics industry have been taken in Brazil where two new companies have recently been formed. Vulcan S.A., a subsidiary of the Companhia Nacional de Tejidos Nord Americana has been established in Rio de Janeiro to manufacture polyvinyl chloride sheets. Last July the production of polystyrol plastics was begun by the Bakol S.A. of Sao Paulo. Both concerns are receiving technical advice from the Bakelite Corporation of New York.

Next Week's Events

MONDAY, FEBRUARY 6

The Chemical Society

Oxford: Physical chemical laboratory, 8.15 p.m. (with RIC). Alembic Club lecture. Dr. H. Irving: "Analytical Chemistry: Science or Art?"

Society of Chemical Industry

London: London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. F. Armitage: "Recent Developments in the Surface Coating Industry."

British Welding Research Association

London: 29 Park Crescent, W.1, 3 p.m. Sir Ben Lockspeiser (DSIR) opens "Research and Production Exhibition."

TUESDAY, FEBRUARY 7

The Chemical Society

Edinburgh: University Medical Buildings, Teviot Place, 7 p.m. (with Edinburgh University Chemical Society, RIC and SCI). Prof. W. E. Garner: "Some Aspects of Solid Reactions."

Chemical Engineering Group (SCI)

London: Burlington House, Piccadilly, W.1, 5.30 p.m. W. H. Coates: "The Manufacture of Titanium Pigments."

Electrodepositors' Technical Society

Birmingham: James Watt Memorial Institute, Great Charles Street, 6.30 p.m. Discussion: "Throwing Power," introduced by G. E. Gardam.

The Institute of Fuel

London: Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. D. Hicks (director, scientific control, National Coal Board): "Scientific Control in the Coal Industry."

Photoelectric Spectrometry Group

London: 47 Belgrave Square, S.W.1, 2.30 p.m. "Stray Light in Relation to Spectrophotometry," introduced by Dr. J. E. Edisbury (Research Department, Lever Bros. and Unilever, Ltd.). Followed by meeting of the Industrial Spectroscopy Group, 6 p.m. Dr. A. C. Menzies (Hilger and Watts, Ltd.) "Spectroscopy in the United States."

WEDNESDAY, FEBRUARY 8

The Chemical Society

Northern Ireland: Belfast, Queen's Hotel, 7.30 p.m. (with RIC, SCI and Society of Dyers and Colourists). E. F. Eaton: "Colours in Food."

Society of Chemical Industry

Dublin: Trinity College, 7.45 p.m. T. Bratt: "Scientific Control in the Transport Industry."

THURSDAY, FEBRUARY 9

The Chemical Society

Bristol: University, 7 p.m. (with RIC and SCI). Prof. M. Stacey: "Studies of Some Organic Fluorine Compounds."

Hull: University College, 6 p.m. (with Hull University College Scientific Society). Dr. H. W. Thompson: "Some Recent Applications of Infra-red Spectroscopy."

The Royal Institute of Chemistry

London: Acton Technical College, High Street, W.3, 7.30 p.m. E. Lester Smith: "Vitamin B_{12}."

Institute of Metals

London: 4 Grosvenor Gardens, S.W.1, 7 p.m. E. J. Vaughan: "Recent Developments and Modern Techniques in Metallurgical Analysis."

Pharmaceutical Society

Manchester: Houldsworth Hall, 7.45 p.m. A. F. Plowman (assistant secretary): "Pharmaceutical Education with a Special Reference to Recent Changes."

Fertiliser Society

London: 26 Portland Place, W.1, 2.30 p.m. R. A. Hamilton: "The Role of Fertilisers in Increasing the Output from Grassland."

FRIDAY, FEBRUARY 10

The Chemical Society

Birmingham: University, Edgbaston, 4.30 p.m. Sir Ian Heilbron: "Fifty Years of Organic Chemistry."

South Wales: Swansea, University College, 5.30 p.m. (with RIC and University College of Swansea Students' Chemical Society). Prof. W. Wardlaw: "Some Problems in Inorganic Chemistry."

Society of Chemical Industry

London: London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 7 p.m. (Fine Chemicals Group.) J. Davidson Pratt (ABCM): "The Economics of the Fine Chemical Industry."

Oil and Colour Chemists' Association

Manchester: Engineers' Club, Albert Square, 2 p.m. N. D. P. Smith: "The Use of the Electron Microscope in Paint Problems."

Institution of the Rubber Industry

Manchester: Engineers' Club, Albert Square, 6.45 p.m. (with Plastics Institute). Maldwyn Jones: "Polythene."

SATURDAY, FEBRUARY 11

Institution of Chemical Engineers

Birmingham: University, Edmund Street, 3 p.m. R. Scott: "Modern Pipe Still Design."

The Stock and Chemical Markets

A MINOR reaction in British Funds made for easier conditions on the Stock Exchange earlier in the week, leading industrials easing with Gilt-edged, although there was very little selling. General Election uncertainties kept business in check in the industrial sections, and in the main movements have not exceeded more than a few pence.

Caution is evident because of indications that many industries are facing growing competition at home and abroad and it is therefore thought that it will be increasingly difficult for companies to maintain net profits. It is, nevertheless, confidently expected that it will be possible to keep the dividends of leading industrials at last year's rates.

As was to be expected, shares of chemical and kindred companies have moved with the prevailing trend. Imperial Chemical, after improving to 41s. 9d., came back to 41s. 3d., at which there is a yield of nearly 4⅞ per cent, and there is general confidence that the 10 per cent dividend will be maintained. A factor which influences the shares is the market assumption that owing to the progressive policy of the group, further capital will be required by I.C.I. in due course, although no early development of this kind is expected. The City believes that if and when more capital is required, shareholders are likely to be given preferential terms of allotment.

Albright & Wilson 5s. ordinary shares remained steady at 29s., being unaffected by market rumours that the company may be contemplating a £1 million issue of 4½ per cent preference shares. Fisons at 26s. 9d. have been steady in the results; the chairman tells shareholders in his annual statement that the raising of additional loan capital to finance commitments, and provide for financing stocks when the fertiliser subsidy ends, is being discussed by the directors.

Brotherton 10s. shares have remained at 19s. 3d., Monsanto were 50s. 9d., Boake Roberts 25s. 6d., and Amber Chemical 2s. shares at 4s. 9d., with F. W. Berk at 14s. 3d., and Bowman Chemical 4s. shares 5s. 3d. L. B. Holliday 4½ per cent preference kept at 19s. 9d., and British Chemicals & Biologicals 4 per cent preference at 18s. 3d. Pest Control 5s. shares were 8s., and Laporte Chemicals 5s. ordinary changed hands around 9s. 6d.

British Glues & Chemicals 4s. shares further strengthened to 19s. 9d. Activity in United Molasses up to 40s. 9d. was attributed to revived talk of share bonus possibilities. Turner & Newall have been firm at 78s. 3d., but Borax Consolidated eased further to 55s. 3d. The 4s. units of the Distillers Co. have been firmer at 17s. 6d. Owing to Continental selling, Lever N.V. fell to 41s., and Lever & Unilever were also lower at 40s. 3d. Associated Cement were 74s. 3d.

Boots Drug were steadier at 47s. 6d. Triplex Glass at 18s. were unaffected by news of further growth in the company's export business. British Aluminium have been firmer at 40s., with British Oxygen 91s., and United Glass Bottle 68s. 9d. Glaxo Laboratories rallied to 43s. 3d.

Market Reports

A STEADY demand continues in most sections of the industrial chemicals market and firm price conditions prevail generally. A good inquiry for export has been reported and actual bookings for Commonwealth destinations continue to be satisfactory. An active request persists for most of the soda products, with caustic soda and bicarbonate of soda moving particularly well. Firmness characterises the position of the potash chemicals. Hydrogen peroxide and formaldehyde remain in good call while the barium compounds, bleaching powder and borax are other items attracting a fair amount of attention. Business on the coal tar products market is again without feature. An active buying interest in the xylols, benzols and toluols has been reported and naphthalene offers find a ready outlet with quotations for the crude qualities a little dearer.

MANCHESTER.—New inquiry and actual business on home trade account has been of fair extent on the Manchester chemical market and a satisfactory feature is that leading industrial consumers continue to press for deliveries against contracts of good quantities of a wide range of light and heavy products. Shipping business locally has remained at around the level of recent weeks. Little change on balance in the general price position has to be noted.

GLASGOW.—There has been a gradual improvement in general business in the Scottish heavy chemicals market during the past week. Export business also continues on the up grade.

SHALE OIL CENTENARY
Origins of Scottish Industry

THE Second Oil Shale and Cannel Coal Conference which the Institute of Petroleum will stage in Glasgow from July 3 to 7 is fortunately placed in time and situation since 1950 marks the centenary of the James Young Patent which brought into being the Scottish shale oil industry. It is, moreover, staged at a time when Scottish Oils, Ltd., the direct descendant of the original project, is engaged in a major expansion of its activities.

Present day developments will be demonstrated by Scottish Oils, which is to act as host to oil men from all over the world, as joint organisers of the conference, with the Institute of Petroleum.

Eye-witness' Account

Less familiar facts about the origins and early expansion of the industry—writes a Scottish correspondent—are preserved in "The Industries of Scotland" written by David Bremner around 1869 and published by Adam and Charles Black in Edinburgh. It gives an interesting eye-witness picture of some of the events in the growth of a major Scottish industry.

Prof. Lyon Playfair, Bremner reports, first saw oil bearing shale at Alfreton in Derbyshire in 1847 and interested James Young, then a chemist in Manchester. A successful plant was established after his first experiments proved the commercial value of the product; this stopped when the raw material was exhausted and was followed by two years of intensive research into the nature of the raw material, its cause and the location of a further source. Coal from Boghead, near Bathgate in Midlothian, tested in 1850, proved to be particularly rich in oil. A patent was taken out for "treating bituminous coal to obtain paraffin and oil containing paraffin" and a site selected near Bathgate. Mr. Young had meantime been joined by a Mr. Meldrum and a Mr. Binney, the former supervising the erection and management of the plant which was erected.

Several companies began work before the expiry of the original patent in 1864, all located in or near the area chosen by Young, who had established Young's Paraffin Light and Mineral Oil Co. (Ltd.), about 1866, and was managing both the Bathgate Chemical Works—his original venture—and the new works.

At that time Addiewell was contemplating the lighting of the village with gas

(*continued at foot of next column*)

from Addiewell. The plant was then producing 1¼ million cu. ft. of gas much of which was surplus to the needs of the plant. An offer was made to Edinburgh to supply gas at a cost of 1s. 6d. per 1000 cu. ft. Bremner, however, does not record whether the City considered the proposal. By this time five locomotives were in use shuttling shale to the works and the number of employees had reached over 1000, 400 of whom were miners. A vast amount of work was being given by the other companies in the area and throughout Scotland and England, in the distribution of Bathgate and Addiewell products. Young was then providing for his workers houses, schools and other community facilities.

Bremner claims "Mr. Young's little factory at Alfreton was the parent not only of the Scotch mineral oil trade but also of that of America; for until he began operations, oil had never been distilled to produce an article of commerce."

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

ARLEE, LTD., Ashtead, chemical manufacturers, etc.—December 29, £500 deb. to Mrs. M. Tuckman, London; general charge. *——. September 27, 1948.

New Registrations

Bollin Chemicals, Ltd.

Private company. (477,503). Capital £1000. Chemical and physical industrial scientific consultants, analysts, assayers, etc. Directors: E. M. Meade and B. M. Meade. Reg. office: 395 Corn Exchange Buildings, 27 Fennel Street, Manchester.

Changes of Name

The following changes of name have been announced: KINGSTON PACKING CO., LTD., to J. Peters (Bridlington), Ltd.; RADI CHEMICALS, LTD., to Radiol Chemicals, Ltd.; SUPER PRODUCTS, LTD., to F. R. Cullingford, Ltd.

Fostering India's Plastics Industry

Tariff Protection, Research and Development

THE close relationship of the plastics industry with basic chemicals and the importance of its development in the national interest were some of the main recommendations of the Tariff Board, in recognition of which the Government of India has decided to grant the industry protection until March 31, 1953.

The existing revenue duty of 30 per cent *ad valorem* on phenol-formaldehyde moulding powder will be converted into a protective duty, while manufacturers with a minimum annual production of 200 tons of moulding powder will be granted a refund of import duty on the three principal raw materials used—phenol, formaldehyde and hexamine.

Government's View

With regard to the recommendation for the reduction of duty from 30 to 20 per cent *ad valorem* on ureas, formaldehyde moulding powder, polystyrene, cellulose acetate, nitrate and butyrate, polyvinyl chloride, casein, resins (other than phenol-formaldehyde resin) sheets, rods and tubes, the Government of India considered that requirements could be adequately met by restricting the reduction in duty to cellulose nitrate (sheets, rods and tubes) rennet casein and polyvinyl chloride resin.

Raw celluloid, imports of which were formerly free for the manufacture of combs and subject to a 30 per cent duty for other uses, will now be subject to a uniform duty of 20 per cent.

Existing revenue duty on electrical accessories will be converted into a protective duty, the preferential rate of 24 per cent in the case of imports from the U.K. being raised to 30 per cent and the standard rate adjusted in accordance with the terms of the Indo-British trade agreement of 1939.

Finishing sections of the industry have developed more quickly than those supplying the basic and intermediate raw materials, so that the plastics industry is at present almost entirely dependent on imported raw materials, moulds and machinery.

Various schemes of research connected with indigenous plastic materials are being carried out and it is hoped by the board that these and the establishment of a larger unit for the manufacture of moulding powders will eventually supply the required raw materials.

The plastics industry, in the view of the Tariff Board, must co-operate in schemes of research by setting aside funds for pilot plant experiments to help the introduction of new processes and materials. Early steps should be taken to formulate and enforce proper standards, both for moulding powder and finished articles.

Salt in India

THE Central Salt Advisory Committee of the Government of India has recommended that there shall be no further import of salt into the country this year. It suggests that the 1949 production of 63.5 million maunds should be increased to 70 million maunds in order to make India self-sufficient in salt. The Government is expected to accept this recommendation, which, it is believed, would save the country over Rs.7 million annually. Production in 1949 was about 15 per cent above that of the previous year.

CLASSIFIED ADVERTISEMENTS

EDUCATIONAL

SITUATIONS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 and 40 inclusive, unless he or she is exempted from the provisions of the Control of Engagement Order, or the vacancy is for employment exempted from the provisions of that order

ANGLO-AMERICAN COMPANY, producing cellulose for the Chemical and allied industries, require a **QUALIFIED PHYSICIST** for laboratory and process control work. Experience in our field not necessary. Age 20-25. Salary not less than £500. Applications giving full details of education and qualifications, to **Chief Chemist, Holden -Vale Manufacturing Company Limited, Haslingden, Lancashire.**

ANGLO-AMERICAN COMPANY, producing cellulose for the Chemical and allied industries, require **TWO QUALIFIED CHEMISTS** for laboratory and process control work. Experience in our field not necessary. Age 20-25. Salary not less than £500. Applications, giving full details of education and qualifications, to **Chief Chemist, Holden Vale Manufacturing Company Limited. Haslingden, Lancashire.**

PROCESS DEVELOPMENT CHEMIST required for Works at Wakefield (Yorks), dealing with products based on Ammonia. Honours Degree or equivalent in Chemistry, with experience in the operation of Chemical Plant; a qualification in Chemical Engineering or Physical Chemistry would be an advantage. This is a senior appointment and salary will be in accordance with age, experience and qualifications. Applications to PERSONNEL OFFICER, Brotherton & Co., Ltd., City Chambers, Leeds.

SITUATION VACANT

WANTED, CHEMIST, for Lancashire Factory manufacturing Fertilisers, Insecticides and similar Horticultural Products. Work mainly routine analytical, but a certain amount of formulation planning and research. Salary, £400 per annum. Box No. C.A. 2898, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4

BUSINESS PREMISES

SUNDERLAND, County Durham, England. Chemical Works, complete with modern plant and buildings, all in excellent condition, available for early occupation. The total existing site measures 23,820 square yards. There is adjoining land available for extensions. First-class shipping facilities for ocean-going vessels are immediately adjacent. The works are rail and road connected. Very advantageous terms for suitable tenants. Early application advisable. Enquiries to the GENERAL MANAGER, River Wear Commissioners, St. Thomas Street, Sunderland, County Durham, England.

FOR SALE

BROADBENT 48-in. SUSPENDED TYPE HYDRO EXTRACTOR, overdriven from 15 h.p. motor 400/3/50 supply, together with Pony motor for slow running.

BROADBENT 48-in. HYDRO EXTRACTOR; three-point suspension, galvanised basket and complete with 15 h.p. motor, starting equipment and reverse current braking switch suitable for 400/440 volt 3-phase 50-cycle supply.

18-in. diam. WILKINSON OINTMENT MILL, with marble refining discs and enamelled hopper and agitator, and complete with driving motor.

TUNGSTONE ACID PUMPS. A number available in Ebonite, Bronze and Tufnol.

SILICA COILS of 2½ in. bore, comprising 60 ft. formed into seven turns at 2 ft. 6 in. diam., complete with teak supporting framework. (Brand new.).

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Yate Bristol, England.
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CHARCOAL (Palm Kernel Shell). Regular Shipment, free sample and price.

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ANJOLA STORES,

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2—5 ft. diam. by 8 ft. long, jacketed.
1—4 ft. diam. by 7 ft. long, jacketed.
6—3 ft. diam. by 7 ft., fitted coils.
2—50 in. diam. by 7 ft., jacketed.

Fitted double doors.
Condition as new.

THOMPSON & SON (MILLWALL) LIMITED
CUBA STREET, MILLWALL, E.14.

FOR SALE

MORTON, SON & WARD LTD.,
— OFFER —
HIGH-CLASS PLANT FOR PAINT AND ALLIED TRADES
REFINING AND GRINDING

ONE—20 in. by 14 in. by 12 in. **TORRANCE MICRO TWIN REFINING MILL,** driven from in-built 7½ in. h.p. slipring motor with rotor stator starter for 400/440 volts, 3-phase, 50 cycles supply. (AS NEW.)

ONE—Similar Machine but arranged for fast and loose pulley drive. (AS NEW.)

ONE—No. "0" Size **CHRISTY & NORRIS DIS-INTEGRATOR,** mounted metal cabinet with bagging-off equipment. Machine driven by 5 h.p. totally enclosed motor, 400/3/50 cycles with new starter.

ONE—11 in. size DITTO but without cabinet or motor.

TWO—4-pot **STAINLESS STEEL BALL MILLS** with two containers 1 ft. 2 in. diam. by 1 ft. 3 in. deep and two 9 in. diam. by 10 in. deep. Units driven through vee-ropes from new enclosed drip-proof motors, 400/3/50 cycles supply.

SEPARATING AND CLARIFYING

SEVERAL—400, 300 and 100 g.p.h. **HOPKINSON SEPARATORS OR CLARIFIERS,** all with in-built motors, 400/440/3/50 cycles supply, with starters.

MIXING

SEVERAL—200-gallon Unjacketed Open-top **MILD STEEL WELDED MIXING PANS,** 3 ft. diam. by 4 ft. 6 in. deep, with overdriven stirring gear. Fast and loose pulleys. (NEW AND UNUSED).

SEVERAL—40-gallon **STEAM-JACKETED MIXING PANS,** 2 ft. dia. by 2 ft. deep with overdriven stirring gear. 50 lb. per sq. in. w.p. in jackets. (UNUSED.)

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CYLINDRICAL AND RECTANGULAR STORAGE TANKS of all sizes and shapes. Inquiries welcomed.

MORTON, SON & WARD LTD.,
WALK MILL, DOBCROSS,
NR. OLDHAM, LANCS.
'PHONE SADDLEWORTH 437.

ONE PELLETING MACHINE, Thompson & Capper. 1½ in. pellet, fast and loose pulley drive. Good condition. £100.

THOMPSON & SON (MILLWALL) LIMITED
CUBA STREET MILLWALL, E.14.

STORAGE TANKS, ALL-WELDED TYPE.

2	Dish ended	22′	× 7′ 6″ diam.
1	,, ,,	19′	× 8′ diam.
3	Open top	9′	diam. × 8′ deep.
5	Flat ended	5′ 9″	diam. × 12′
2	Closed	20′	× 10′ × 10′
2	,,	10′ 6″	diam. × 13′
1	,,	7′	diam. × 6′
1	Dish ended	5′	diam. × 16′
1	,, ,,	10′	diam. × 7′ 6″
1	Open top	24′	× 9′ × 6′
1	Closed	14′	× 6′ × 4′
4	,,	10′	× 6′ × 4′
10	,,	6′	× 4′ × 4′

MADEN & McKEE, LTD.,
317, PRESCOT ROAD
LIVERPOOL, 13.

STORAGE TANKS, RIVETED TYPE.

1	Closed	12′	diam. × 8′
4	,,	8′	diam. × 30′
3	,,	7′ 6″	diam. × 28′
1	,,	10′	diam. × 28′
2	,,	7′	diam. × 26′
1	,,	5′	diam. × 20′

MADEN & McKEE, LTD.,
317, PRESCOT ROAD,
LIVERPOOL, 13

FOR SALE

WELDED STORAGE TANKS.

9	Dish ended	8′	× 3′ 6″ diam.
20	Flat ended	6′	× 3′ 9″ diam.
10	Open top	3′ 9″	× 6′ diam.
1	,, ,,	6′	× 4′ 9″ diam.
1	,, ,,	10′	× 5′ × 5′
1	,, ,,	10′	× 4′ × 6′
1	,, ,,	6′ 6″	× 4′ × 5′ 6″
2	Dish ended	6′	× 3′ 6″ diam.

MADEN & McKEE, LTD.,
317, PRESCOT ROAD,
LIVERPOOL, 13.

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21 in. **DIAL THERMOMETERS,** 0°–100° C., capillaries 10 ft. to 50 ft. steel bulbs 4 in. long; 2½ in. ditto, 40°–140° C. capillaries 10ft. to 12 ft., bronze bulbs 4 in. long, 10s. each. Cannot be repeated. We have a wide range of Thermometers, Pyrometers, Pressure and Temperature Recorders, by good makers.

CLECKHEATON ENGINEERING AND MOTOR CO., LTD., CLECKHEATON. 'PHONE – 397.

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20 First-class All-Welded Dish-ended **Steel STORAGE TANKS,** each 29 ft. by 10 ft. diam. Inspection by arrangement.

MADEN & McKEE LTD.,
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LIVERPOOL, 13.

CHEMICAL PLANT FOR IMMEDIATE DISPOSAL

30 Vertical **PRESSURE** or **VACUUM VESSELS,** 5 ft. 9 in. diam., 8 ft. high, dished ends, 75 lb. w.p.
16 horizontal, 5 ft. 7 in. diam., 8 ft. 6 in. long, 6 ft. 10 in. by 5 ft. 9 in. diam. **ALUMINIUM OPEN TOP TANKS.**
5 ft. 3 in. by 3 ft. 9 in. diam. **ENCLOSED ALUMINIUM TANKS.**
20 ft. 4 in. by 4 ft. by 2 ft. 8 in. **COPPER OPEN TOP,** 1,330 gallons.
Iwel **STEAM DRIVEN EXTRACTOR,** 60 lb. pressure.
Six **STEAM DISINFECTORS,** 7 ft. long, 3 ft. diam.
STEAM BOILERS—400 in stock, new and reconditioned, also **AIR COMPRESSORS, MIXERS, REDUCTION GEARS, PIPES,** jacketed **STEAM PANS,** etc.
Send for illustrated catalogue containing 5,000 items—"Watkins Machinery Record."

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'PHONE 98 STAINES

48 1N. and 18 in. **HYDRO EXTRACTORS,** self-contained, 400/3/50.
JACKETED STEEL VACUUM OVENS, 8 ft. by 5 ft. diam. and 6 ft. by 4 ft. diam.
"U" SHAPE 4 cwt. **POWDER MIXER** by "Alite" B.D.
JACKETED STILLS, 14 ft. by 5 ft. diam. (steel) with agitating gear.
TWIN "Z" BLADE MIXERS, 50 in. by 48 in. by 33 in. and all sizes down to 16 in. by 16 in. by 14 in. deep.

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1000 STRONG NEW WATERPROOF APRONS. To-day's value 5s. each, Clearing at 30s. dozen. Also large quantity Filter Cloths, cheap. Wilsons, Springfield Mills, Preston, Lancs Phone 2198

FOR SALE

600

PROCESS PLANT

DRYING INSTALLATION by **MANLOVE–ALLIOTT** of Nottingham, comprising rotary drier 60 ft. long by 8 ft. diam., constructed ⅜ in. plate, two roller paths, drive on to main girth gear through open reduction gear. Bennis unit patent travelling grate stoker 43½ sq. ft. grate area for the furnace at feed end, also dust extraction plant by Sturtevant, comprising 32 in. steel cased fan and two 11 ft. diam. cyclone dust collectors.

M.S. ROTARY DRIER, drum 25 ft. by 5 ft. I.D., with short screen at discharge end, fitted internally M.S. channel flights and two roller paths running in tandem rollers. Drive through girth wheel and pinion with countershaft and F. & L. pulleys. Heating by multi-bank gilled tubes.

FILTER PRESS by **JOHNSON**, recessed plate type with 69 C.I. plates 40 in. square, forming cakes 37½ in. square by ⅞ in. thick. Pyramid surfaces, centre feed 3½ in. diam. Individual bottom side outlets. Complete with double acting pump. Drive by F. & L. pulleys.

FILTER PRESS by **SAMPSON MOOR FOUNDRIES,** recessed plate type with 31 plates, forming cakes 22½ in. square by 1 in. thick. Centre feed 2½ in. diam. Individual plate discharge. Complete with collecting trough.

FILTER PRESS, RECESSED PLATE TYPE, with 11 plates forming cakes 22 in. square by 1¼ in. thick. Centre feed 1½ in. diam.

FILTER PRESS by **JOHNSON,** plate and frame type with 38 plates forming 39 cakes 28 in. square by ⅞ in. thick. Centre feed 3 in. diam., enclosed discharge 2 in. diam.

FOUR PEERLESS MIXERS 80 quart cap. Fitted integral 5 h.p. motor 400/3/50, with various whisks and beaters.

DUPLEX MIXING & KNEADING MACHINE by **MORTON** of Wishaw., steam jacketed trough approx. 42 in. by 38 in. by 30 in. cap. 115 gal. Fitted twin G.M. mixing blades, double Naben type and counter balanced jacketed lid. Int. w.p. 15 lb. sq. in. or high vacuum. 25/30 h.p. required to drive.

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SUNBEAM ROAD, LONDON, N.W.10
Tel.: Elgar 7222/7 and
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CHARCOAL, ANIMAL and VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams, "Hilljones, Bochurch, London." Telephone: 3285 East.

PRESSURE FILTER, 16 in. diam. by 40 in. high, with 50 filter plates and cloths.

TWIN "META" FILTER, capacity 3,000 gals. per hour.

"JOHNSON" FILTER PRESS, with 22 cast-iron recessed plates, each 26 in. diam.

"JOHNSON" ALL-METAL FILTER PRESS PUMP, two rams, 2½ in. diam. by 5 in. stroke.

"WEIR" FEED PUMP, 3,000 gals. per hour.

"MIRACLE" MILL. Chamber, 22 in. diam., with Cyclone and magnetic separator.

DARTNALL,
248, Humberstone Road, Plaistow, London, E.13

FOR SALE

VARIOUS MIXERS FOR SALE

No. 200 **ONE** nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR,** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double "U"-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the top of the tipping screw.

No. 201 One **DITTO.**

No. 202 One **DITTO.**

No. 203 One **DITTO.**

No. 204 One **WERNER PFLEIDERER MIXER OR INCORPORATOR,** similar to the above, with a C.I. built pan 25 in. by 25 in. by 19 in. deep, belt pulleys 26 in. diam. by 5 in. face, double fin-type agitators, and mounted on C.I. legs.

No. 205 One larger **WERNER-TYPE MIXER OR INCORPORATOR,** by Dobson & Barlow, with C.I. built pan or mixing chamber, of the double "U" type, 4 ft. 6 in. by 3 ft. 7 in. by 3 ft. 10 in. deep, with a jacketed bottom and sides to within about 12 in. of top, and fitted with double "Z" type agitators, counterbalanced cover, machine-cut gears at each side, steel back-frame with counterbalancing weights and self-contained belt-driven tipping gear and main triple fast and loose belt pulleys 30 in. diam. by 6½ in. face, with belt fork. Approximate overall sizes, 12 ft. long by 8 ft. wide by 10 ft. high.

No. 206 One **DITTO** of the same pattern, by **DOBSON & BARLOW**

No. 207 One **DITTO** of the same pattern by **DOBSON & BARLOW**

No. 208 One **DITTO** by **WERNER PFLEIDERER,** with a C.I. built pan or mixing chamber, of the double "U" type, 4 ft. 5 in. long by 3 ft. 8 in. by 33 in. deep, with double "Z" mixing arms, gears at each end, hand-operated tilting gear, with steel backframe, counterbalancing weights and chains, and fast and loose pulleys 3 ft. diam. by 6 in. face.

No. 209 One **HORIZONTAL "U"-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

No. 210 One **HORIZONTAL MIXER** as above.

No. 211 One **HORIZONTAL MIXER** as above.

No. 212 One **HORIZONTAL MIXER** as above.

No. 213 One **HORIZONTAL MIXER** as above.

No. 214 One **HORIZONTAL MIXER** as above.

These six "U"-shaped mixers are in some cases fitted with steel plate covers and a steam jacket round the bottom and extending to within about 18 in. of the top with plain end plates.

Further details and prices upon application

Write RICHARD SIZER LIMITED ENGINEERS
CUBER WORKS HULL.

METAL Powders and Oxides. Dohm Limited, 176 Victoria Street, London, S.W.1.

WANTED

BALL MILL required, 500 gallons or greater working capacity, porcelain or other similar lining essential. State make, price dimensions, details of lining and where inspected to FERGUSON & EDWARDS, LTD., ABBEY ROAD, BARKING, ESSEX. RIPPLEWAY 3871.

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EDWARD RUSHTON, SON AND KENYON (Established 1855).

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DOHM, Ltd., pulverise raw materials everywhere 167, Victoria Street, London, S.W.1.

GRINDING, Drying, Screening and Grading of materials undertaken for the trade. Also Supplier of Ground Silica and Fillers, etc. JAMES KENT, LTD., Millers, Fenton, Staffordshire. Telegrams: Kenmill, Stoke-on-Trent. Telephone 4253 and 4254, Stoke-on-Trent (2 lines).

GRINDING of every description of chemical and other materials for the trade with improved mills.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hilljones, Bochurch, London." Telephone: 3285 East.

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Specialising in

INDUSTRIAL and FINE CHEMICALS, DRUGS, SOLVENTS, PLASTICS, and all materials for manufacturing industries throughout Australia and New Zealand.

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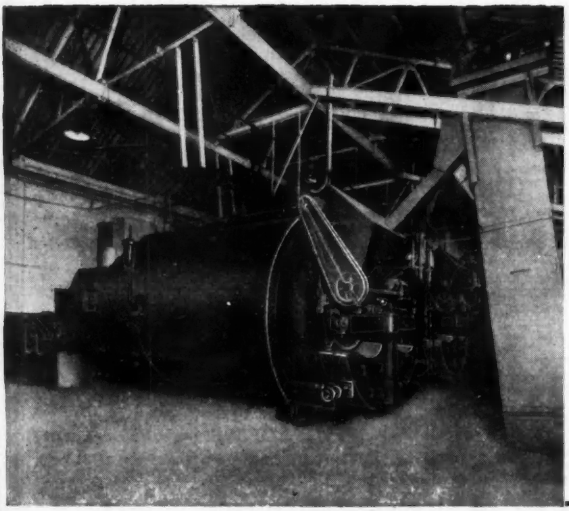

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